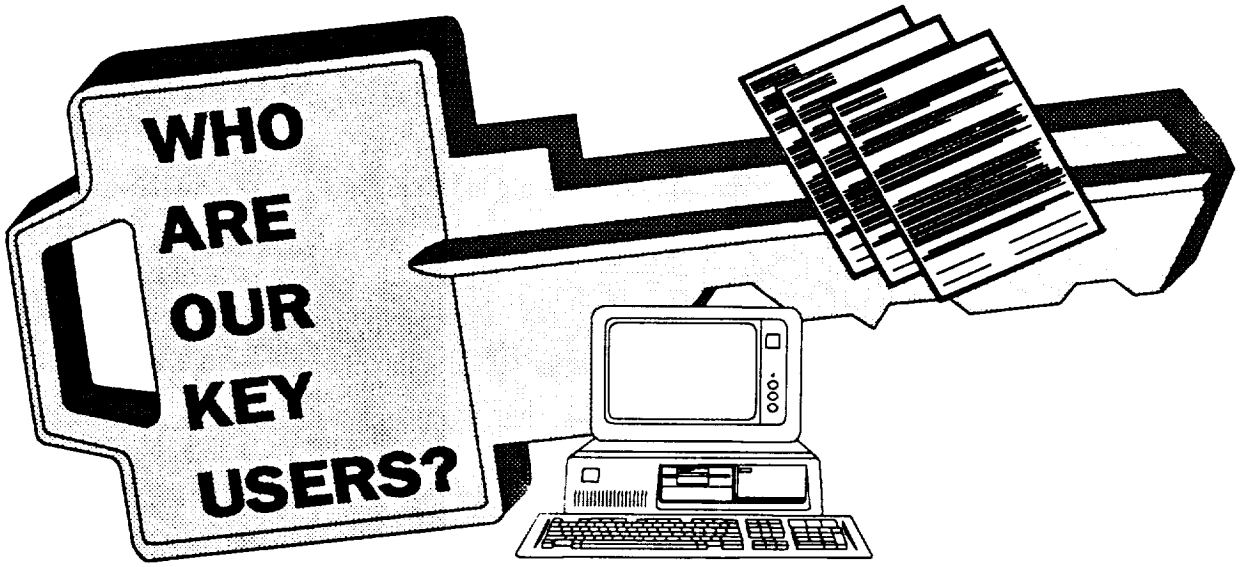
NASA-TM-108021

P. 101

NASA STI PROGRAM

COORDINATING COUNCIL

Sixth Meeting — OCTOBER 25, 1991



(NASA-TM-108021) COORDINATING COUNCIL. SIXTH MEETING: WHO ARE OUR KEY USERS? (NASA) 101 p

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***** SUMMARY *****

NASA STI PROGRAM COORDINATING COUNCIL MEETING

Who Are Our Key Users?

October 25, 1991
10:00 am - 4:00 pm

Crystal City Gateway 2
Conference Room

Attendees:

AIAA
- Barbara Lawrence
- David Purdy
- Geoff Worton

CASI
- Wanda Colquitt
- Carl Eberline
- Joe Gignac
- Dian Marincola

GSFC
- Jane Riddle

JTT
- Katie Bajis
- Xenia Castell
- Gladys A. Cotter
- Jim Erwin
- Jennifer Garland
- Linda Hill
- Judy Hunter
- Karen Kaye
- Allan Kuhn
- Lucinda Leonard
- Georgianna Lira
- Elizabeth Nestor
- Ann Normyle
- Lou Ann Scanlan
- Ron Sepic
- Patt Sullivan
- Ardeth Taber
- Teresa Taylor
- Phil Thibideau
- Dick Tuey
- Kay Voglewede
- Leslie Wassel
- John Wilson

JZ
- Roland Ridgeway

LaRC
- Thom Pinelli

LMI
- Denise Duncan
- Cynthia Shockley

MITRE
- Kristin Ostergaard

INTRODUCTION

Jim Erwin, JTT, welcomed the attendees, thanked those who had helped with the meeting, and announced that Geoff Worton would be presenting in place of Barbara Lawrence. He then reminded the attendees that this meeting on users followed naturally from the last meeting, on quality of the database.

PRESENTATIONS

Dian Marincola, CASI, presented statistics on "Key Users: Who Uses the System the Most, Who Orders the Most Documents." The statistics are shown in the vu-graphs (attached); a summary follows.

In 1990, the NASA entities that received the most documents from the NASA Scientific and Technical Information (STI) Program in both paper and microfiche were, in order, Goddard, Ames, and Langley. Those that received the most documents in paper copy were, in order, Langley, Lewis, and Goddard. Among non-NASA entities, "other domestic" affiliations (the public, universities, and research institutes) ordered the most, followed by international partners (those with whom NASA has bilateral or tripartite agreements), NASA contractors, government agencies (including entities within government agencies), and other foreign organizations.

The most registered RECON users in 1990 were other domestic affiliations, followed by NASA, international partners, government agencies, NASA contractors, and other foreign. Government agency contractors and domestic partners (NTIS, OSTI, and DTIC) had fewer than 100 users each.

Non-NASA users registered to receive documents on initial distribution were, in order, other domestic, international partners, NASA contractors, government agencies, and other foreign.

Of 25,000 secondary (ad hoc) requests for documents (after automatic distribution), NASA contractors ordered the most, then domestic partners, international partners, other domestic, and other foreign.

Langley executed the greatest number of RECON commands (SELECT, EXPAND, BROWSE or TYPE, ORDER, and PRINT were those counted) of any NASA Center, followed by Lewis and Ames. There is no correlation drawn between the number of commands executed and the amount of time spent using RECON.

Denise Duncan and Cynthia Shockley, LMI, presented their findings from the Gateway Requirements Analysis: "What Do Users Say?" They visited three NASA Centers—Langley, Lewis, and Ames—and found the following information.

Those doing basic and applied research look for information at three major junctures: 1) beginning a project, to find what's already been done on the subject; 2) if their hypotheses seem wrong, to see if they need to change suppositions or to see if new information can get them back on track; and 3) upon publication, to obtain references.

Scientists find their STI in two ways: informally, through peers, their personal libraries, and their division libraries; and more formally, through official STI sources. Younger researchers are more comfortable with electronic media such as database searches and electronic mail. The best searches are conducted cooperatively, with the research librarian (information broker) conducting the search and the scientist at his elbow providing directional guidance to home in on her topic. In the near future it is likely that scientists will uncover sources of information themselves, using electronic networks and specialty electronic bulletin boards. Information brokers will maintain the universe of good sources.

Research scientists want their STI in three basic formats: text documents for basic research concepts and descriptions of entire experiments, numeric data sets for specific pieces of research, and graphic modeling or simulation (physical observation data, graphic images of computational tools; and animated representations, sometimes with color and sound) to represent large data sets, for specific areas of research. To date the graphic formats are available only through peer networking, not through information brokers.

How can this STI be made available to those who want it? The National Space Science Data Center (NSSDC)'s Master Directory is a beginning.

The potential market for the STI Program consists of some 26,000 scientists and engineers who are NASA employees and contractors. Personnel statistics are available for NASA employees (about half this population) but not for contractors. There is little cross-correlation of disciplines and functions among NASA Centers. Ames and Langley have the most research scientists with aerospace or astronautics engineering degrees, and the most development engineers with degrees in electronics or electronic communication. Goddard, Marshall, and Johnson are similar to each other; Kennedy is strong on test and evaluation, installation, operation, and maintenance.

Discussion: Today the scientific community's focus is on advanced and critical technologies. The National Center for Advanced Technologies (NCAT) has produced a validated list of such technologies and is developing a strategic plan for each one. Much of the newest technology is not obtainable through searchable databases; a researcher can only find it via a peer

networking system. There is no one place where all of this information is catalogued.

Geoff Worton, AIAA, talked about "Users: What Do We Know About Them?" His presentation is summarized here.

Users of AIAA's products and services (*IAA*, the Aerospace Database, and library services and document supply) can be classified into three groups:

1. Librarians, information professionals, information brokers
2. Engineers, scientists, consultants, researchers
3. Teachers, students

AIAA's membership is divided among industry (40%), government agencies (31%), academia (7%), and other (mostly consultants and service companies)(23%). Only 9 percent are foreign, and these are evenly divided among government, industry, and academia.

The subscription renewal rate for *IAA* is 97 percent. This represents a slight decrease in the past 6 years, but it's still a high rate. One reason is that access to the online database is limited, especially in Europe, and thus users continue to need the print version. The decline in renewals is a result of the availability of many other online databases containing similar information (Inspec, DOE, NTIS, Compendex). The CD-ROM version of the database is too new to yield statistics on use.

Among U.S. users of the Aerospace Database, 71 percent are in industry, 16 percent in government, and 13 percent in academia. In Canada, users split evenly between industry and government with 43 percent each, followed by 13 percent academics. Australian users are all affiliated with the government; in Israel, the split is 67 percent government to 33 percent industry.

The preferred method of searching on DIALOG is by keyword(s) (90%), followed by author (3%).

An analysis of references and articles in the *AIAA Journal* revealed that more than a third cited material more than 10 years old (33%). This means that much aerospace research (and, therefore, STI) is of basic and lasting value.

Contributors to the Aerospace Database: U.S. 50%, Europe 20%, Russia 15%, other 15%.

CITATIONS OF LITERATURE	AIAA Journal	ZFW (Germany)	Recherches Aerospatiales
United States	85%	41%	41%
Europe	11%	52%	44%
USSR	01%	01%	01%
Other	03%	06%	14%

Discussion: Before the 1980s, most of the AIAA literature came from the United States. Perhaps peer contact was a factor: known sources are more credible. Now the proportion of foreign literature is increasing as more contacts are made; a third of the attendees at meetings are foreign. The time lag for translation may also contribute to the lower rate of use of foreign sources.

Thom Pinelli, LaRC, next presented some of the results from his NASA/DoD Aerospace Knowledge Diffusion Research Project, on "Potential Key Users."

The thesis of this project is that for scientists and engineers to maintain a position on the cutting edge of technology, they must be able to acquire the information they need in a form that is immediately usable and easily incorporated into their work. This is an *active* style of information delivery, as opposed to the National Science Foundations's premise that if you create knowledge the world will beat a path to your door (*passive* delivery).

There are three models for knowledge delivery in the U.S.: the economic model, the appropriability model (NSF view), and the dissemination model.

The dissemination model is an intermediary-based system.

The U.S. Government uses models 2 and 3 to distribute research and development (R&D) results: NASA R&D reports are now distributed using model 2, to institutions; health care and education reports use model 3, distribution to the end user. The discrepancy occurs because health care and education information is seen as critical to the end user.

The long-term goals of Pinelli's project are to describe and analyze the dissemination of aerospace knowledge, specifically within NASA and DoD. To do this he will look at the users, how they interact with each other and with the system; and also look at the interfaces between government and industry and between government and academia.

Then he proposes to compare aerospace scientists and engineers in the U.S. with those in other countries, and look at other systems (Japan, Russia, etc.) from a policy and policy analysis point of view: are they intermediary-based systems? How do they interface? After conceptualizing, describing and analyzing other systems, Pinelli proposes to move into some modeling and predictions from which he'll derive a marketing strategy for STI.

The Keller Group, in the process of determining whether NASA's STI Program is viable, asked Pinelli for information about the production and use of STI within NASA, and especially at five Centers: Ames, Goddard, Langley, Lewis, and Marshall. With the mechanism for the Knowledge Diffusion Project already in place, the information was easy to gather using a telephone survey. Of the respondents, 70 percent were engineers; 23 percent, scientists; 4 percent, managers; and 3 percent, technicians.

NASA purports to be a science organization, but in terms of what it does and who does it, it is a technology-driven engineering organization. This colors the entire process of information delivery. Only a quarter of the respondents did their research alone; the others were all members of a team or group. The STAR categories most represented were engineering, aeronautics, and space science. Only 22.1 percent of the respondents had earned a doctorate; 32.6 percent had a masters, and 45.3 percent had a bachelor's degree or less. The proportion of women was 8.7 percent (there are fewer in AIAA and almost none in SAE). Center Directors and Deputy Directors were excluded from the survey.

How important is it... (percent of respondents)	very important	somewhat important	not important
to publish STI?	47.4	28.2	24.3
.. through the STIP?	25.6	33.6	44.8
to use STI?	80.6	17.5	1.8
.. is STIP to you?	47.5	35.8	16.8

Most of those surveyed, 61.1 percent, said they had no problems with the STI system. Only 9.9 percent experienced problems; of those, 8.6 percent said the process was too time-consuming. This perceived problem could be corrected with better communication between the Centers and the Headquarters publishing operation. Most of the time lag in publishing occurs in the production of the document, and production can be accelerated with author-publisher cooperation throughout the process.

A quarter of the respondents said they used the NASA STI Program once a month, 30 percent used it more often, and the rest said either that research wasn't part of their job or they had their own libraries. A quarter of the respondents, again, experienced problems accessing the system; another 15 percent said it took too much time and effort.

In evaluating the STI Program overall, however, 82 percent gave it either excellent (28.2%) or good (54.4%).

The bottom line result of the survey was that the STI Program is used and is meeting the needs of the majority of those it serves. Perceived problem areas will be addressed using focus groups and discussions.

Jane Riddle, GSFC, discussed "How We Meet the User's Needs" from her perspective as information intermediary in the STI Program. The summary follows.

In 1989 the Goddard library surveyed its users. The survey asked who the users were, what they liked, what they didn't like, and what they would like in terms of library services.

Users of the Goddard library are government employees, contractors, NRC/NAS research associates, co-op students, and a small group of "other": people in private industry, authors, retired scientists, and retired engineers. Civil service grades range from 10 through 16; age levels are 25-55 and getting younger. Goddard encourages its affiliation with local universities and hires many recent graduates.

The heaviest users are engineers, space scientists, and earth scientists. Project scientists and managers are also well represented.

Users come to the library to find a specific reference or fact, to explore a new topic, to update material on a recurring topic, to browse among the new materials, and to seek help in any of these areas.

The research tools the Goddard library users prefer are the databases, RECON (for which they use an intermediary) and ARIN (which they use themselves); the card catalog, now on microfiche but not updated; and do-it-yourself with help from Goddard's brochures—user manuals for the library. Users ask for help with all of the above-mentioned tools. Some specific questions take longer to answer; for example, from 15 to 60 minutes; these tend to be quests for obscure references of for sources that are not bibliographic information. Research questions can encompass an entire research package: printed materials, online, information, and referrals both within and outside of Goddard. The library also has CD-ROMs: Books in Print, the Science Citation Index, Computer Select, GEOREF, and INSPEC.

The tools most liked by the users are ARIN, whose usage is growing, often remote access; and RECON, although the users would prefer a CD-ROM version and find RECON hard to understand. They would like to have ISI access through ARIN.

Medium-use tools are microfiche from CASI and AIAA papers. The least used tools are RECON directly (users find its promotional materials too verbose), *SCAN* (not dynamic enough; it used to be heavily used), and *IAA* and *STAR* in paper versions.

Users would like to have ISI; the breadth of DIALOG; STN spread: physics, chemical abstracts, INSPEC, American Institute of Physics' SPIN; electronic transmission of search results; other electronic tools such as fax and electronic mail; and optical scanning capability.

Discussion: It is not yet possible to access the information "in RECON" through ARIN or NOTIS, because the databases would have to be converted, the cost is too high for the limited demand, and some fields in RECON have no equivalent in NOTIS. Some Goddard users requested coverage of additional journals in the IAA database; Goddard has given a list of these journals to AIAA.

Kristin Ostergaard, MITRE, presented a "STI Council User Requirements Update." The preliminary findings are summarized here.

At the behest of the STI Council, MITRE undertook a two-fold study, of STI usage and of STI users. Its timeframe is from May 1991 through April 1992. The methodology of the study is to 1) gather statistics from CASI for 1990, 2) gather additional statistics from STI staff at Centers, and 3) survey samples of high-volume STI users and of nonusers of STI across all Centers.

Some of the background information for the study comes from CASI (statistics from 1990) and some from the survey of users that LMI performed in 1990.

Preliminary results show that in eight Centers, half of the STI managers or designees could estimate the number of total users of STI, three-quarters could identify the most active users, half could identify the less active users, and 63 percent maintain usage records.

Discussion: Heavy users such as General Electric or Hughes Aircraft could be sources of additional revenue for the STI Program. Their usage pattern differs from that of the Centers in that they get tapes from CASI and generate their own documents from them. In addition, they use the tapes for internal-use searches and have subscription services; thus they have little need for further products or services from CASI. The STI Council wants to

see the user as a customer rather than as a potential market. The NASA Charter is vague—it's not clear whether it mandates NASA to disseminate STI throughout NASA (only) or to anyone who wants it. Nonetheless, it should be kept on mind that technology transfer and technology utilization are also parts of the NASA STI Program.

KEY USERS —

Who Uses the System the Most,

Who Orders the Most Documents

A Brief Review of the Data

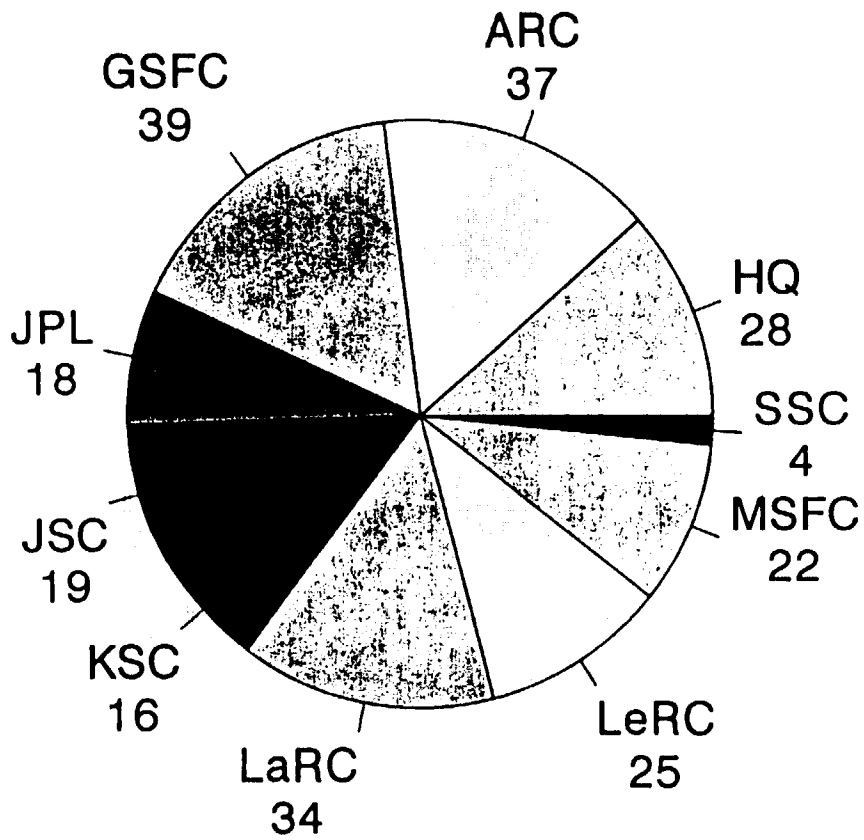
- 1990 data profiled
- Data organized by CASI registration affiliation types
- Data extracted from RPCS, document order files, and RECON usage files
- Data are data.

Active Addresses on RPCS in 1990

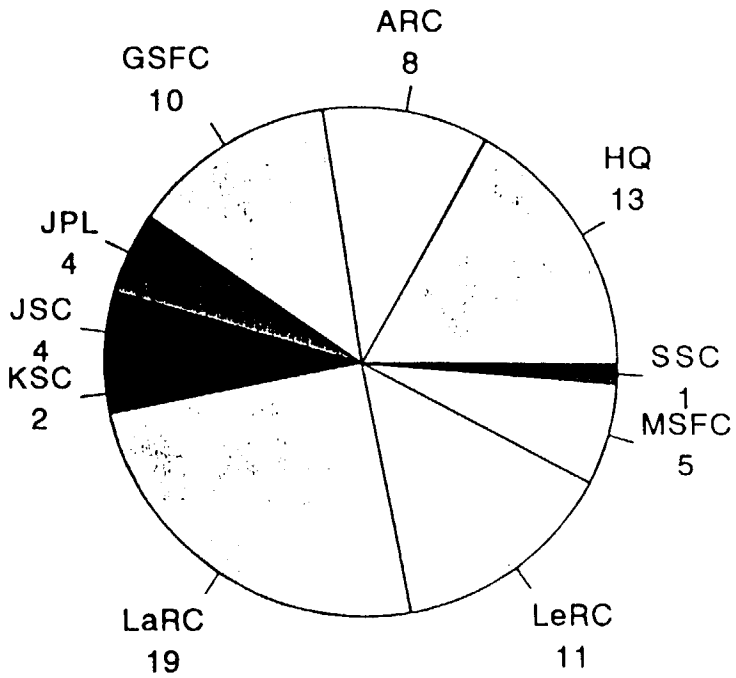
- 1,600 NASA
- 340 NASA Contractors
- 540 Gov't Agencies
- 80 Gov't Agency Contractors
- 30 Domestic Partners
- 740 International Partners
- 2,500 Other Domestic
- 160 Other Foreign

Estimates

Documents Distributed to NASA Entities in 1990



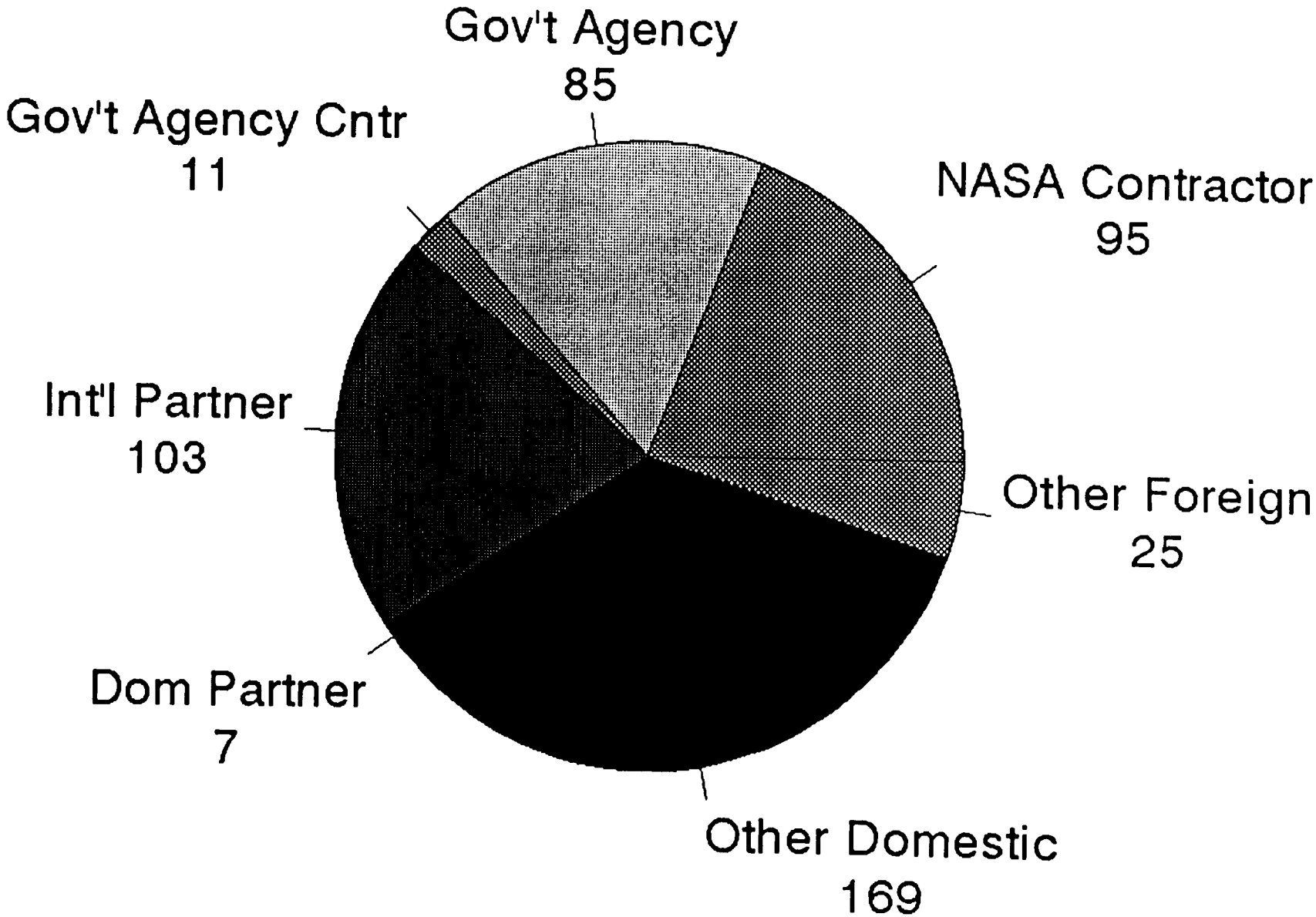
Paper and Microfiche



Paper Copy Only

In thousands

Initial Distribution

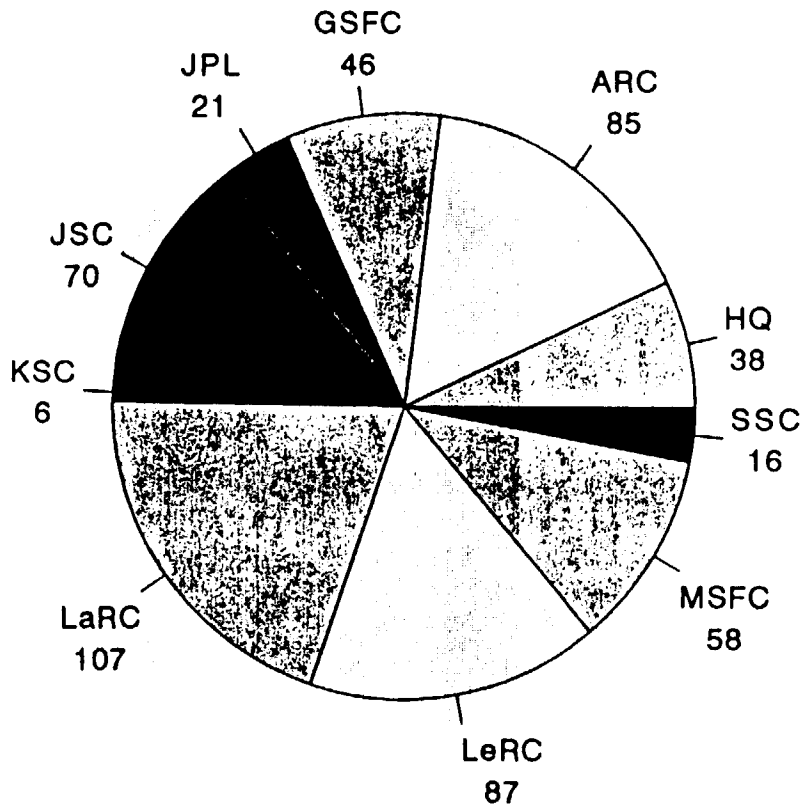


Non-NASA Entities on Initial Distribution

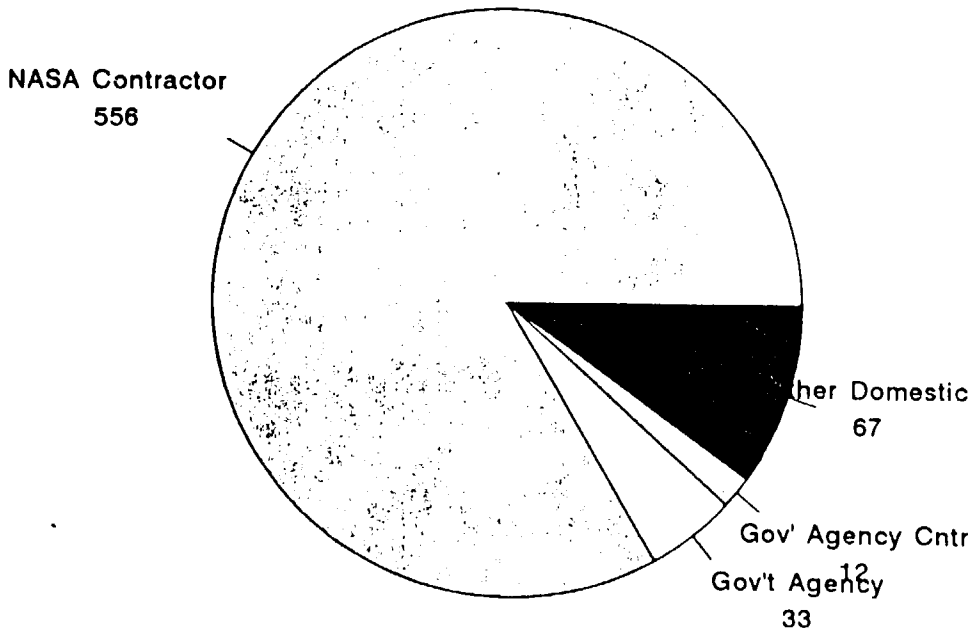
High Volume Document Requesters

- NASA CONTRACTORS
  - 721 Hughes Aircraft Co, CA
  - 357 Rockwell International Corp, CA
  - 287 NERAC, Inc, CT
- GOVERNMENT AGENCIES
  - 29 Wright-Patterson AF Base, OH
  - 26 Arnold AF Station, TN
  - 16 Naval Ship R&D Ctr, MD
- GOVERNMENT AGENCY CONTRACTORS
  - 42 Teledyne Ryan Aeronatical, CA
  - 32 Rockwell Int'l Corp/NAAO, CA
  - 13 Rockwell Int'l Corp/SSED, CA
- DOMESTIC PARTNERS
  - 781 NTIS, VA
  - 160 OSTI, TN
- INTERNATIONAL PARTNERS
  - 172 ONERA, France
  - 103 Nat'l Aerospace Lab, The Netherlands
  - 97 Nat'l Aerospace Lab S&T Agency, Japan
- OTHER DOMESTIC
  - 152 General Dynamics Corp, TX
  - 26 Ithaco, Inc, NY
  - 13 AVCO Corp, MA
- OTHER FOREIGN
  - 125 Indian Space Research Organization, India
  - 31 Instituto de Pesquisas Espaciais, Brazil

RECON Commands Executed in 1990



NASA Entities



Non-NASA Entities

In thousands

RECON Commands Executed by Non-NASA Entities

Heavy Users?

- NASA CONTRACTORS
  - 44,644 Rockwell Int'l Corp/STSD, CA
  - 44,543 WESRAC, CA
- GOV'T AGENCY
  - 18,088 Arnold AF Station, TN
  - 9,026 Wright-Patterson AF Base, OH
- GOV'T AGENCY CONTRACTOR
  - 9,101 Rockwell Int'l Corp/SSED, CA
  - 6,837 Sandia Labs, NM
- Other Domestic
  - 14,198 Research Triangle Institute, NC
  - 11,949 Fairchild Space Co, MD

Volumes based on a single RECON ID

LMI

STI PROGRAM COORDINATING COUNCIL MEETING

25 October 1991

"WHAT DO OUR USERS SAY?:

An LMI [Limited] Perspective"

Presentation by:
Denise R. Duncan
Cynthia W. Shockley

LMI

FINDINGS FROM GATEWAY REQUIREMENTS ANALYSIS

MAJOR FINDING: Key Function Supported is Research

[Research in several contexts: basic research, applied research during design, etc. through lifecycle of NASA work]

- **Events which trigger an STI search**
  - .. **Project intiation, recheck if/when hypothesis not supported, at publication**
- **How do users do the STI search**
  - .. **First stage – personal resources – own library, peer library, ask peers**
  - .. **Second stage – official STI resources**
- **Management of research requires both STI and administrative information**

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FINDINGS FROM GATEWAY REQUIREMENTS ANALYSIS

MAJOR FINDING: NASA Research Population is Changing

[Distribution of employee age and years of experience is changing as well as increasing numbers of contract support staff]

- **Bimodal age distribution**
  - .. **Corporate memory will be retiring over next 10 years**
  - .. **Peer contacts will be leaving NASA**
  - .. **Younger staff may be versatile in using online resources**
  - .. **Younger staff may have higher expectations of STI delivery system**

- **Between 1989 and 1991, NASA lost more than half of its GS/GM 13-15 scientists and engineers. Overall there was a net gain of 237 with new hires.**

- **NASA's work force declined from 31,000 in 1970 to 23,500 in 1990 whereas the support-service contractor population increased from 29,000 to 41,000**

LMI

FINDINGS FROM GATEWAY REQUIREMENTS ANALYSIS

MAJOR FINDING: User Community for STI Program are NASA Researchers and Information Brokers who Directly Support Them

[We understand that the charter includes dissemination to the general aerospace community, but if STIP satisfies the more technically demanding NASA users, the external users should be satisfied.]

- Researchers form the primary market for STI – these are NASA scientists and engineers, TPMs, contract scientists and engineers, university researchers – in support of NASA projects.

- Information brokers supporting these people are part of the primary market as substitutes for the researcher in the STI search and retrieval process – these are Center librarians, CASI, IACs, TUOs, and university librarians.

- The major difference between these two groups is in their patterns of STI search, sources used, and expertise in location and retrieval of STI.

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FINDINGS FROM GATEWAY REQUIREMENTS ANALYSIS

MAJOR FINDING: User Community for STI Program are NASA Researchers and Information Brokers who Directly Support Them (continued)

- Researchers use peers and local resources first and "official" STI resources (library, RECON) second. Information brokers use STI program resources first and are far more likely to make systematic use of online resources.

- Disconnect between researcher and information provider
  - A researcher will discover unique sources
  - Sources used are not communicated to information brokers by researchers

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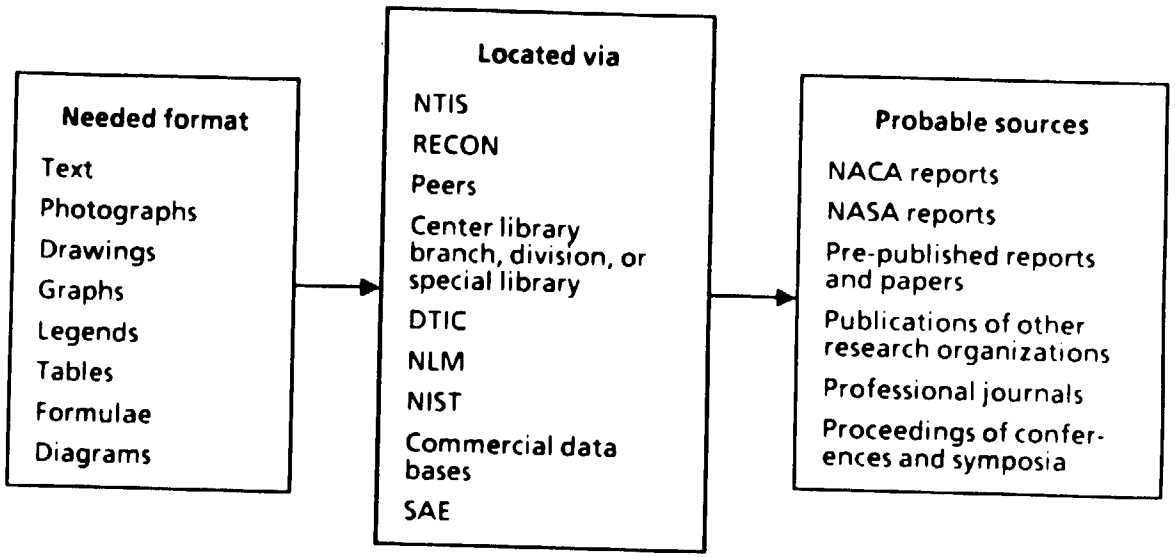
FINDINGS FROM GATEWAY REQUIREMENTS ANALYSIS

MAJOR FINDING: Peers are an Important Part of the STI Research Process

- **Members of a group with similar research interests assist one another with locating sources of STI, whether those sources are other researchers, professional groups, discipline-specific bulletin boards, etc.**

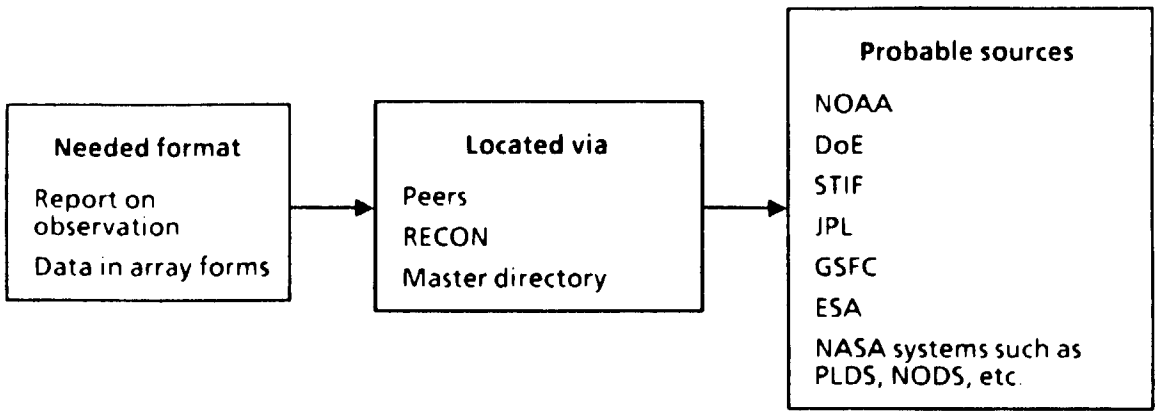
- **The Internet is a major channel of communication among peers.**

Users Have Identified Types of STI, Needed Formats, and Probable Sources of Required STI as Follows:



Notes: NTIS = National Technical Information Service; NLM = National Library of Medicine, NIST = National Institute of Standards and Technology; SAE = Society of Automotive Engineers, NACA = National Advisory Committee for Aeronautics

FIG. 5-3. TEXT IN DOCUMENT FORM



Notes: NOAA = National Oceanographic and Atmospheric Administration; DoE = Department of Energy, JPL = Jet Propulsion Laboratory; GSFC = Goddard Space Flight Center; ESA = European Space Agency

FIG. 5-4. OBSERVATION DATA

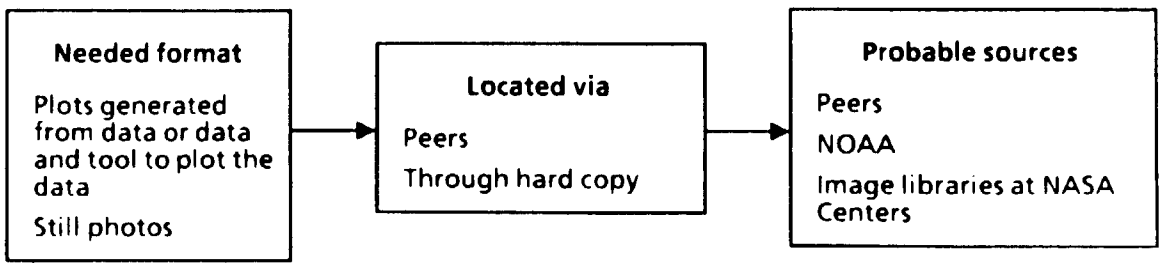
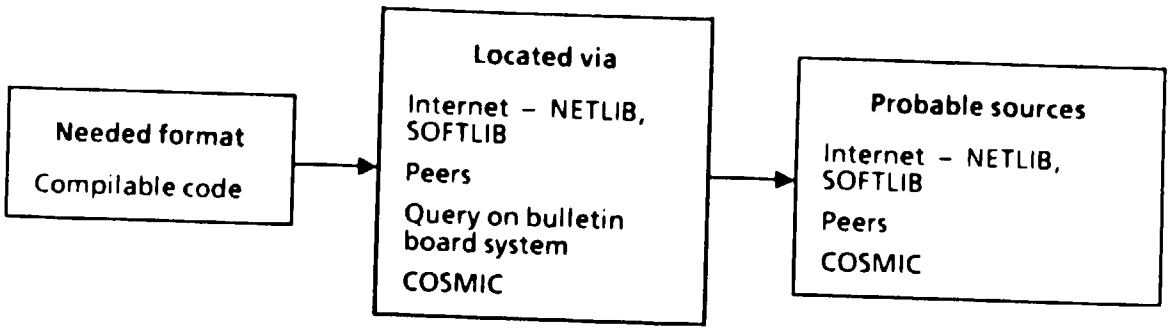


FIG. 5-5. GRAPHIC IMAGES



Notes: NETLIB = Internet's Mathematical Software Distribution system; SOFTLIB = Software Distribution System on Internet; COSMIC = Computer Software Management and Information Center.

FIG. 5-6. COMPUTATIONAL TOOLS

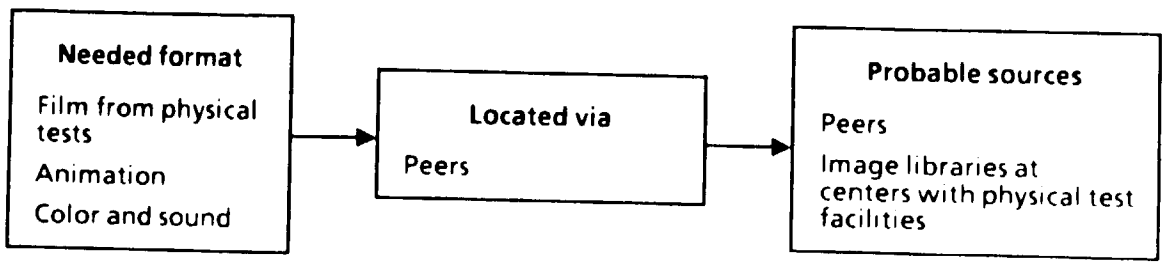


FIG. 5-7. VIDEO IMAGES

LMI

LMI VIEW OF KEY NASA STI USERS

Internal Factors Which Contribute to STIP Challenge

- Potential users of STI in support of NASA mission (NASA and NASA contractors) is about 26,000
  - .. There are between 10,000 to 13,000 scientists and engineers in NASA
  - .. There are 13,000 NASA contractors (figure was 6500 in 1987)
  - .. Limited insight into the contractor user population which may be 50% of users
- Each Center tends to be insular and compete with others for research dollars
- Each NASA Center is unique in its user population composition and consequently STI profile
  - .. Distribution within research, engineering, development, T&E functions at each Center different from other Centers
  - .. No clear categorization across Centers by discipline

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LMI VIEW OF KEY NASA STI USERS

External Influences

- Impact of Space Exploration Initiative (SEI)
- Impact of other Agency programs
  - DoD spends twice as much as NASA on space research and development
  - Overlap between agencies

Present and future technologies required for the Space Exploration Initiative

Functional requirement	System characteristics	System options
Propulsion		
Surface to low earth orbit	High thrust, 150–250-metric-ton capacity	Advanced chemical-fuel rockets (cryogenic liquids, non-cryogenic liquids, solids)
Transfer orbit to the moon and Mars	Restartable motors; stable, storable propellants; for Mars, very high specific impulse	For the moon, current propellants and systems; for Mars, nuclear thermal rockets, nuclear electric propulsion
Insertion into planetary orbit and descent to surface	Throttleable; high reliability required; long-term cryogenic storage	Not demonstrated by present systems
Electric power		
Moon mission spacecraft	Manned: up to 30 kW for week(s); unmanned cargo: up to 5 kW for week(s)	Nuclear: presently 7 W/kg with radioactive thermoelectric generators
Mars mission spacecraft	Manned: up to 20 kW for year(s); unmanned cargo: up to 5 kW for year(s)	Fuel cells: presently 250 Wh/kg Batteries: presently 20 Wh/kg
Moon and Mars mission surface activities	Habitat/laboratory: 30–100 kW; base: 100–1000 kW; rovers: 100–4800 kWh per trip	Photovoltaic: presently 21 Wh/kg at earth Photovoltaic with storage batteries: presently 3 W/kg
	All systems reliability must be greater than 99 percent, with minimal support for continuous operation	Photovoltaic with fuel cells: presently 0.7 W/kg on the moon; will need to be 3 W/kg on Mars Direct power transmission: no practical system available
Extravehicular activities		
Space suit	Suit gloves must be reliable, mobile, flexible, comfortable, easily maintainable; their design affects suit's internal pressure, breathing gas mixture	Current suit designs not adequate for long stays on the moon or Mars
Life support systems		
Waste management	Technology largely driven by closure of food cycle (recycling human and plant waste)	Key research areas: plant growth techniques, food production, waste processing, contaminant control, and systems integration and control
Water recovery	Organic and inorganic waste removal from multiple sources; must provide drinkable water	Distillation systems, thermoelectric integrated membrane evaporation, vapor compression, bioregenerative (plant-growth-based) systems
Air revitalization	Carbon dioxide reduction and removal; oxygen generation; trace-contaminant control	Molecular sieve, chemical reactors (Bosch or Sabatier), direct carbon dioxide electrolysis
Planetary surface systems		
Habitats	Moon: six persons for week(s) to 18 for year(s); Mars: six for month(s) to 18 for year(s) Radiation protection, simple maintenance essential	Inflatable and rigid structures
Rovers and walkers	25–100-km radius for several-day missions	Sensors, software
Robots	Teleoperated; require data rates over 500 megabits per second, resolution 30 arcseconds at center; user-friendly, dependable, and rugged	Very high-definition stereo television (10 000-line TV)
Site characterization		
Stereo visual imaging	Local maps with 1-meter resolution; global maps with 10–100-meter resolution	Achieved with present technology
Resource characterization	Multispectral imaging, chemical, and evolved gas analyses	Spectrometers, electromagnetic sounders, gas chromatography, surface penetrators
Spacecraft		
Low-earth-orbit personnel shuttle and heavy lifter	Spacecraft designs limited by materials properties and fabrication methods	Current spacecraft designs based on aluminum and titanium
Moon and Mars transfer vehicles, cargo transfer vehicles, landers	Minimal on-orbit assembly, maximum crew safety, radiation protection	Light alloys, metals, ceramics, polymer matrix composites need development; radiation shielding possibilities include water, magnetic, and electrostatic
Communications, control, navigation		
Mission control, science data return, radiometric support for navigation	Moon: downlink 350 Mb/s, uplink 250 Mb/s Mars: downlink 20 Mb/s; uplink 10 Mb/s Navigation: 10 meters accuracy Driven by imagery data rates	Present interplanetary navigation systems cannot adequately support real-time Mars navigational requirements; options include optical bands, phased-array antennas, multibeam antennas, millimeter-wave integrated circuitry, expert systems, neural networks, data compression techniques

Source: *America at the Threshold*: Report of the Synthesis Group on America's Space Exploration Initiative, May 1991

Agencies and their missions in the U.S. space program

Agency	Initial budget for space, millions of US dollars (year)	1990 budget for space, millions of US dollars	Space activities and missions
Department of Defense	489.5 (1959)	19 382	Develops the National Launch System heavy lift booster jointly with the National Aeronautics and Space Administration (NASA), researches and develops the Strategic Defense Initiative (SDI), and operates the Defense Satellite Commmunications System (DSCS) and the Defense Meteorological Satellite Program (DMSP)
National Aeronautics and Space Administration	261 (1959)	11 393	Researches, develops, and operates technology for the space shuttle, space station, interplanetary probes and orbiting astronomical observatories, space and earth sciences and their applications, and manned and unmanned space exploration, encourages commercial space programs, technology transfer to universities and industries
Department of Commerce	50.7 (1962)	243	Oversees both polar-orbiting and geostationary operational weather satellites, administers the land remote-sensing program (which is conducted by Earth Observation Satellite Co., Lanham, Md.), and helps develop telecommunications policy for the use of geostationary orbits
Department of Energy	34.3 (1959)	190.3	Develops nuclear electric power reactors for U.S. earth-orbiting and interplanetary spacecraft, and provides instrumentation for space-based monitoring of nuclear weapons test ban
Department of Agriculture	0.5 (1968)	23.4	Conducts applications research on space-based systems for monitoring, assessing, and managing agricultural and forest resources, and impact analysis on droughts and floods
Department of the Interior	0.2 (1968)	15.5	Maintains remote-sensing resource data archive; uses remote-sensing data to inventory, monitor, and manage natural resources; assists various countries in remote sensing and geographic information systems; and has helped develop interplanetary spacecraft sensors and produced maps of planets and satellites
Department of Transportation	0.5 (1987)	3.5	Through the Office of Commercial Space Transportation, oversees and coordinates the U.S. commercial space transportation industry by issuing launch licenses, establishing insurance requirements, and researching policy issues
Arms Control and Disarmament Agency	—	—	Represents the United States in arms control negotiations, including those of space weapons systems
Department of State	—	—	Advises the President on international space matters, is responsible for evaluating and advancing U.S. foreign policy interests in the context of space activity, and represents the United States in international negotiations concerning space issues
Environmental Protection Agency	—	—	Conducts research and technical support using satellite remote sensing as part of an overall environmental monitoring program
National Science Foundation	—	—	Supports academic research in atmospheric sciences and ground-based astronomy
Smithsonian Institution	—	—	Conducts basic research and public education on astronomy and space-related topics
U.S. Information Agency	—	—	Disseminates information about U.S. achievements in space to other countries

Source: *Aeronautics and Space Report of the President: 1988 Activities*, NASA, 1990

USERS: WHAT DO WE KNOW ABOUT THEM?

GEOFF WORTON
AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

NASA STIP COORDINATING COUNCIL

OCTOBER 25, 1991

USERS: WHAT DO WE KNOW ABOUT THEM?

User Services

- International Aerospace Abstracts
- Aerospace Database
- Library/Document Supply

User Types

- Clearly defined market

Usage Characteristics

- Aerospace Literature shelf life
- U.S. vs. Foreign Source Material

Who are STIP's Users?

Librarians
Information Professionals
Information Brokers

Engineers
Scientists
Consultants
Researchers

Teachers
Students

Where are STIP Users?

Academia
Government/Government Agencies
Industry

American Institute of Aeronautics and Astronautics

Professional Members

30%	Government/Government Agencies
40%	Industry
7%	Academia
23%	Other

91%	U.S.
9%	Foreign

International Aerospace Abstracts

Print resource, available since1961

User Type	U.S.	Foreign
Government	21%	31%
Industry	32%	35%
Academia	47%	34%

Subscriber Base	U.S.	Foreign
1987	66%	34%
1991	59%	41%

International Aerospace Abstracts

Subscription Renewal Rate

96% U.S.
98% Foreign

Geographic Breakdown of Foreign Subscribers

16% Pacific Rim
17% U.K.
38% Western Europe/Scandinavia
7% Eastern Europe

International Aerospace Abstracts

Overall subscriptions declining, but

IAA experience better than other print A & I

Closer to core

Restricted availability of online in foreign markets

Why a decline?

Online availability

- Quicker
- Cost effective
- Space saving

Improved global access to online

Alternative sources weaken exclusivity

Aerospace Database

Online via DIALOG Information Services since 1985

Availability

U.S.
Australia
Canada
Israel

User Types	U.S.	Australia	Canada	Israel
Academia	13%	------	14%	------
Industry	71%	------	43%	33%
Government	16%	100%	43%	67%

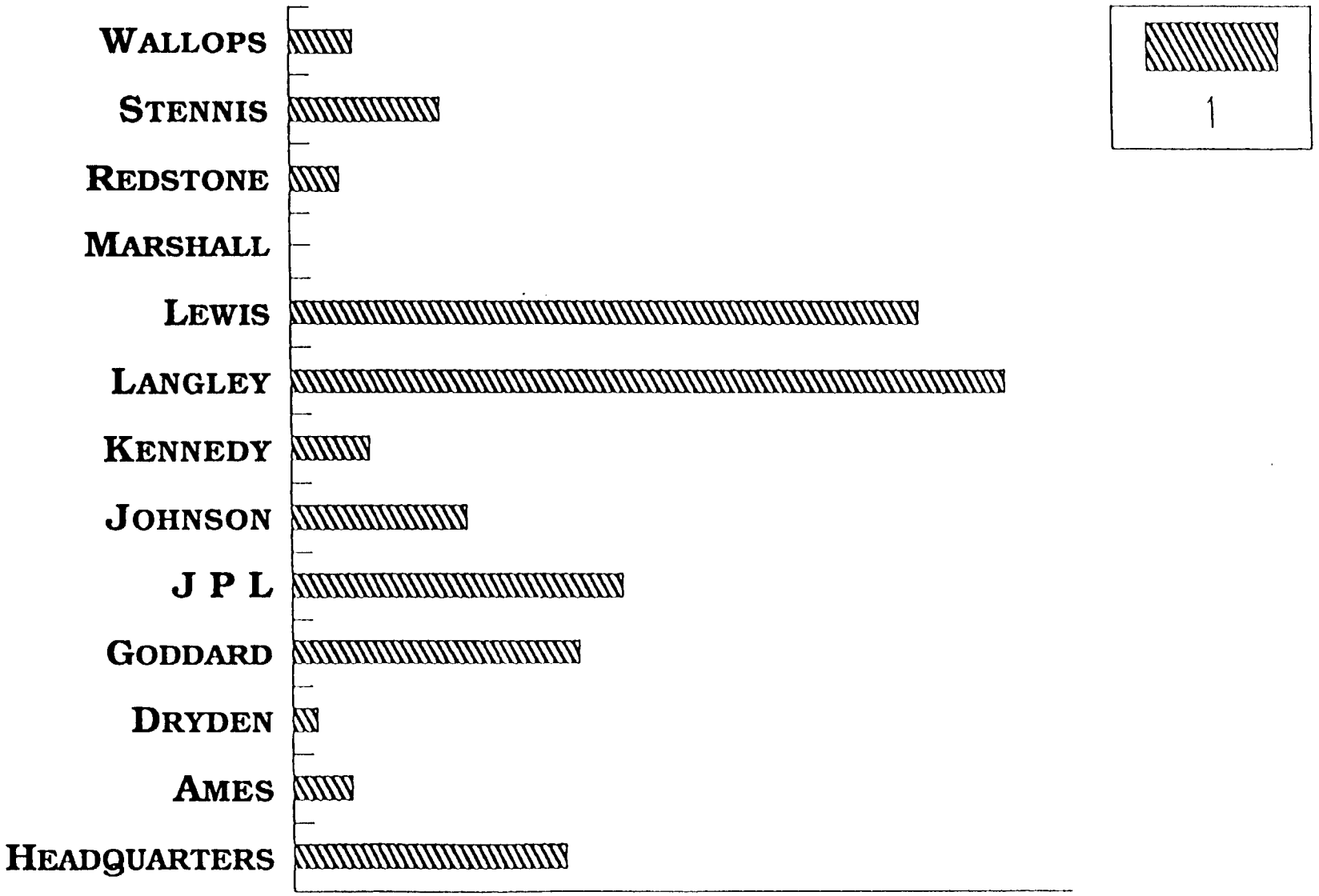
Library Document/Supply

INTERLIBRARY LOANS

	PERIODICALS	REPORTS	BOOKS	TOTAL
Langley	8	5	24	37
Johnson	2	2	10	14
Lewis	13	5	7	25
Stennis	10	---	4	14
CASI	1	1	---	2
HQ	6	3	6	15
SSFPO	3	---	---	3
Kennedy	2	2	2	6
Ames/Moffett	---	2	2	4
Goddard	---	---	3	3
Ames/Dryden	---	1	---	1
TOTAL	45	21	58	124

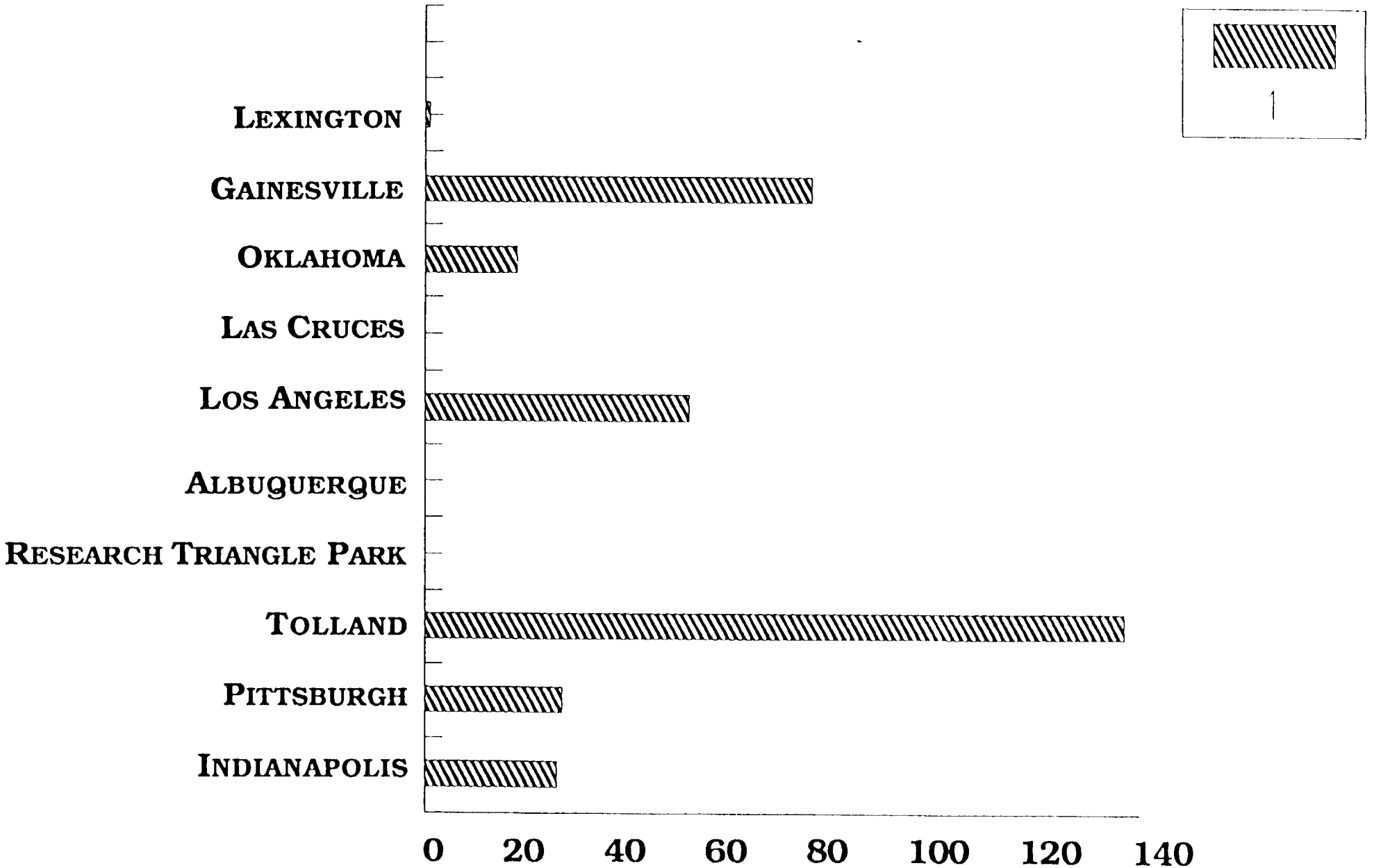
LIBRARY/DOCUMENT SUPPLY

THIRD QUARTER 1991



THIRD QUARTER (CONTINUED)

NIAC's



NATURE OF THE LITERATURE

LONG LIFETIME

CITATION AGE

5 YRS	6-10 YRS	>10 YRS
43%	24%	33%

Aerospace Literature Distribution vs. Utilization

(%)	U.S.	Europe	USSR	OTHER
Literature Distribution	50	20	15	15
Literature Use - % Citations				
AIAA J	85	11	1	3
ZFW	41	52	1	6
RECHERCHE AEROSPATIALE	41	44	1	14

NASA / DoD Aerospace Knowledge Diffusion Research Project

"To understand the process by which the results of NASA / DoD aerospace research diffuses into the aerospace R&D process"

NASA / DoD Aerospace Knowledge Diffusion Research Project

Assumptions

- Knowledge production, transfer, and utilization are equally important components of the aerospace R&D process
- Diffusion of knowledge resulting from NASA / DoD aerospace R&D is indispensable in maintaining the vitality and competitiveness of the U.S. aerospace industry
- The professional competency of U.S. aerospace engineers and scientists and their ability to be innovative and productive depends on a number of factors, but largely on their ability to acquire and process the results of NASA / DoD funded aerospace R&D

NASA / DoD Aerospace Knowledge Diffusion Research Project

4 Phase Project

1. Information seeking behavior of U.S. aerospace engineers and scientists

- Self administered mail surveys
- Members of the American Institute of Aeronautics and Astronautics (AIAA) and the Society of Automotive Engineers (SAE)

2. Industry and government: the information intermediary interface

- Self administered mail surveys
- Aeronautics, aerospace, and engineering libraries in government and industry with DoD and NASA technical report collections and U.S. government depository (state) libraries receiving NASA technical reports

NASA / DoD Aerospace Knowledge Diffusion Research Project

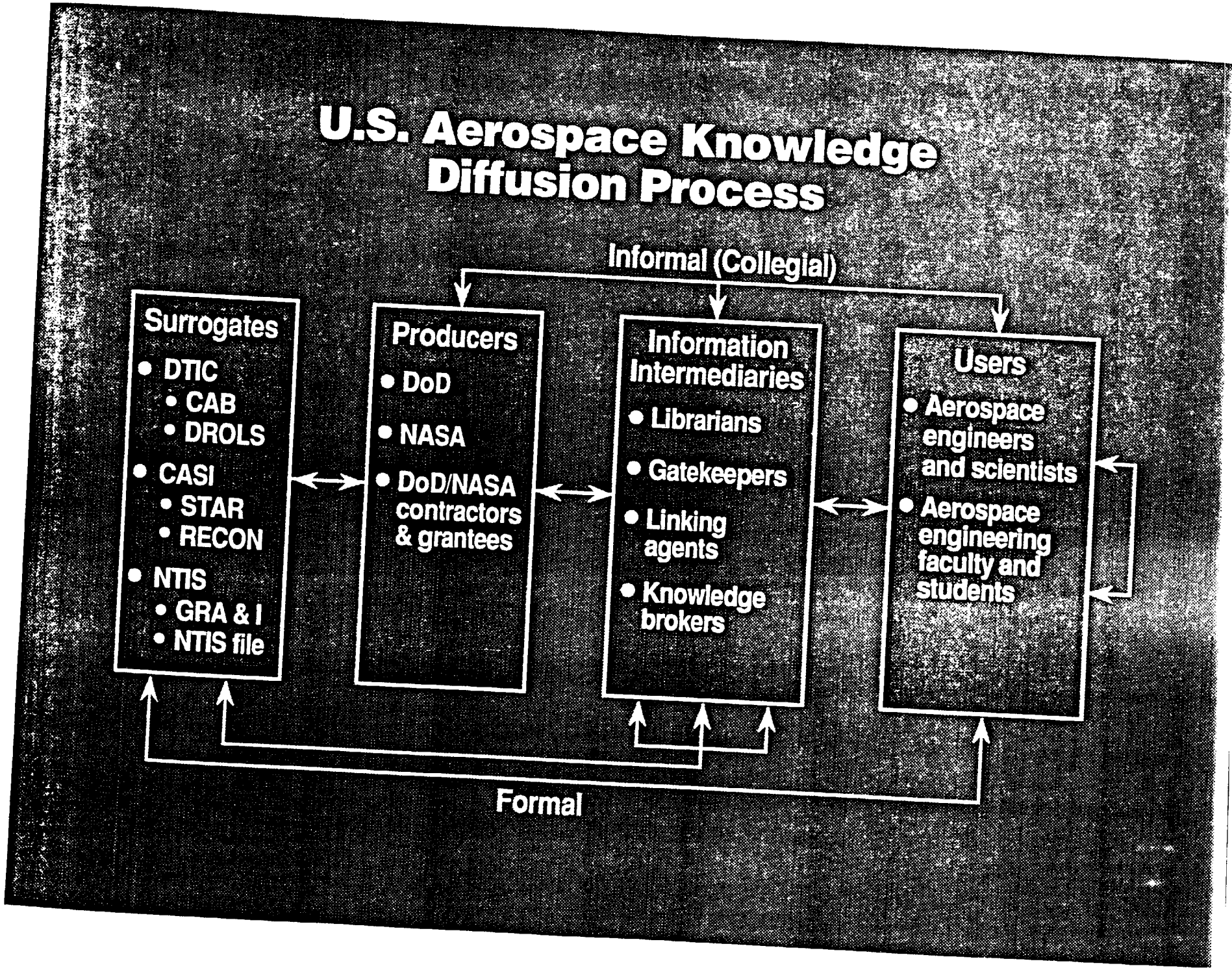
4 Phase Project

3. Academia and government: the academia faculty, students, and information intermediary interface

- Self administered mail surveys
- U.S. colleges and universities with University Space Research Association (USRA) capstone courses in aerospace departments

4. Information seeking behavior of non-U.S. aerospace engineers and scientists

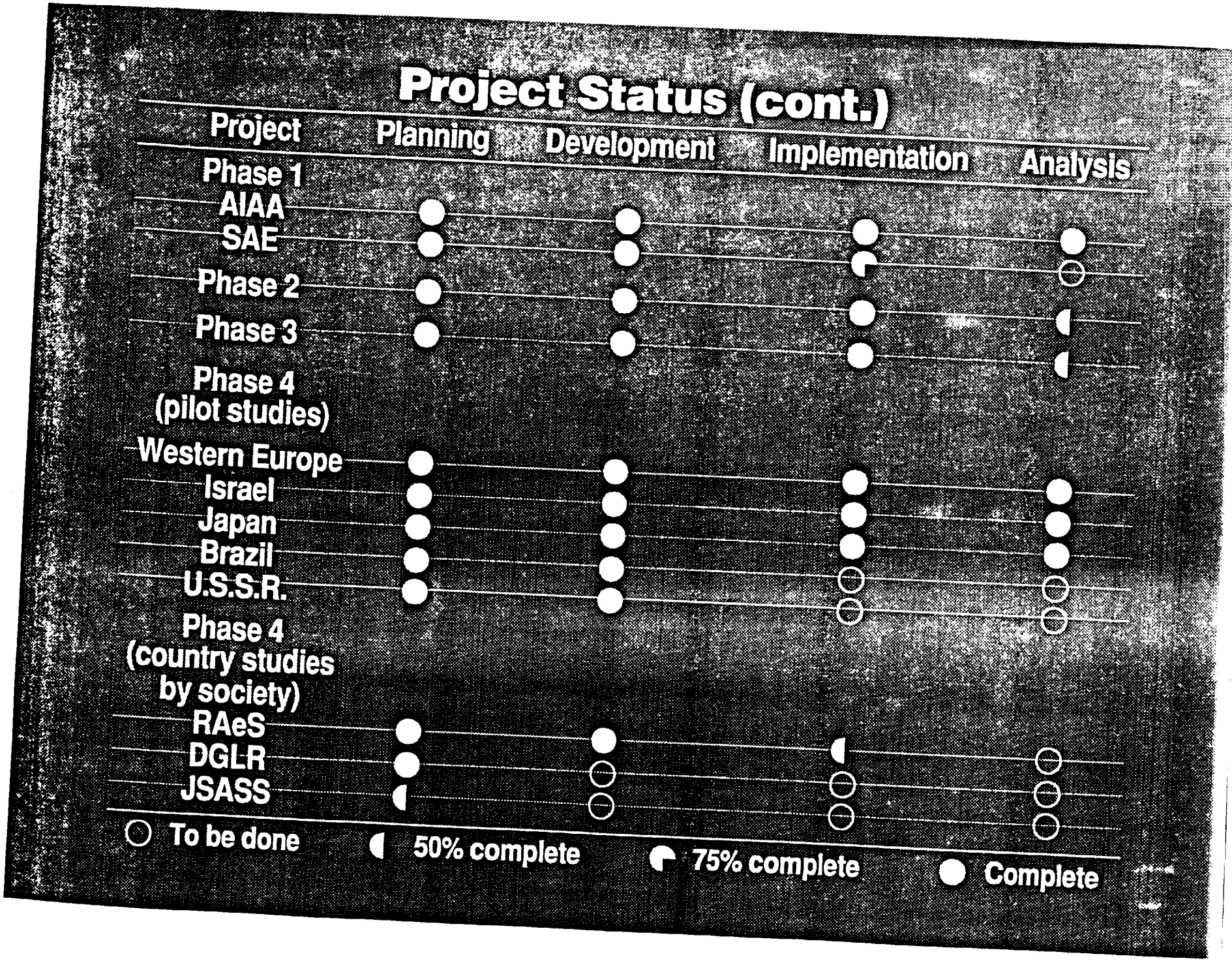
- Self administered mail surveys
- Pilot studies in selected non-U.S. countries


U.S. Aerospace Knowledge Diffusion Process
Informal (Collegial)
Surrogates
• DTIC
• CAB
• DROLS
• CASI
• STAR
• RECON
• NTIS
• GRA & I
• NTIS file
Producers
• DoD
• NASA
• DoD/NASA contractors & grantees
Information Intermediaries
• Librarians
• Gatekeepers
• Linking agents
• Knowledge brokers
Users
• Aerospace engineers and scientists
• Aerospace engineering faculty and students
Formal

Project Status

The relative status of the four phases comprising the initial thrust of the project appears below. Status is stated in terms of definition, development, implementation, and analysis.

- **Planning** — Task is stated in terms of objectives to be accomplished and measureable outcomes; study group and sample frame identified; and feasibility and relative cost/difficulty established.
- **Development** — Task is planned and documented; questions formulated, reviewed, and pretested; questionaires printed and transmittal letters prepared; samples selected and verified; and data collection and analysis established.
- **Implementation** — Task is undertaken; questionaires are mailed, returned, and processed; and data are input, adjusted, and reduced.
- **Analysis** — Task is completed; data are analyzed, documented, and presented.


Project Status (cont.)
Project
Planning
Development
Implementation
Analysis
Phase 1
AIAA
SAE
Phase 2
Phase 3
Phase 4
(pilot studies)
Western Europe
Israel
Japan
Brazil
U.S.S.R.
Phase 4
(country studies
by society)
RAeS
DGLR
JSASS
To be done
50% complete
75% complete
Complete

An Initial Investigation into the Production and Use of Scientific and Technical Information (STI) at Five NASA Centers: Results of a Telephone Survey

by

Nanci A. Glassman
and
Thomas E. Pinelli, Ph.D.

presented at the
NASA Johnson Space Center
Houston, Texas
Monday, October 21, 1991

Purpose

- To provide NASA management with an "initial" look at the production and use of scientific and technical information (STI)
- To provide NASA management with a "gross" assessment of the NASA STI system from the perspective of 5 NASA centers

Methodology

- Telephone interviews (surveys)
- 23 interrogatives
  - 3 open ended
  - 20 closed ended
- Survey pretested using NASA Langley personnel
- Sample frame (list) provided by STI contacts at 5 NASA centers
- Weighted sample drawn from each center's list
- Only CS employees interviewed

Methodology

Sampling Variability Estimates

- With a total sample size of 550, we are 95 percent certain that any percentages in the report would be within ±4.05 percentage points (assuming a dichotomous question)
- Sampling error estimates for the five individual centers are as follows:

	AST Population	Sampling Error
Ames Research Center	1186	±8.90%
Goddard Space Flight Center	2181	±9.10%
Langley Research Center	1414	±8.97%
Lewis Research Center	1583	±9.00%
Marshall Space Flight Center	2504	±9.15%

Methodology

Results of Phone Calls

1865 phone numbers were used in the process of obtaining 550 interviews. Most numbers were contacted 2 to 4 times.

Contacted / unusable numbers:

7	*were disconnected phone lines*
39	*were wrong numbers*
1	*involved a language barrier*
5	*were no longer employed at that facility*
36	*were on vacation / travel*
20	*refused to participate*
125	*were contractors or clerical employees*
550	*completed interviews*
783	*contacted*

Never contacted:

217	*were unanswered phones each time we called*
51	*had busy signals each time we called*
658	*had voice mail / answering machines*
156	*could have been called at a later date / in meetings*
1082	*not contacted*

Methodology

NASA Centers

	Weighted Total
Ames Research Center (California)	13.4%
Goddard Space Flight Center (Maryland)	24.6%
Langley Research Center (Virginia)	16.0%
Lewis Research Center (Ohio)	17.8%
Marshall Space Flight Center (Alabama)	28.2%
	100.0%
	(n = 550)

Note: Originally, 110 people from each center were interviewed. As detailed in the methodology, this sample was balanced to raise each center's AST population to its correct proportion.

If you were to define what you do at work, would you say you are an engineer, a scientist, or something else?

	Weighted Total
Engineer	70.1%
Scientist	23.1%
Manager	3.8%
Technician	3.0%
	100.0%
	(n = 550)

Which of these categories best describes what you do at work?

	Weighted Total
An individual researcher	25.7%
A member of a project team or group	37.1%
A technical manager or supervisor	20.1%
Engineering or research support staff	15.1%
Administrative support staff	1.9%
	100.0%
	(n = 550)

If you could use only one term to characterize your area of work or the application of your work, would it be

	Weighted Total
Aeronautics	29.0%
Astronautics	8.0%
Engineering	30.8%
Space Sciences	20.8%
Chemistry and Materials	0.5%
Geosciences	3.1%
Mathematical and Computer Sciences	4.2%
Physics	1.7%
Social Sciences	1.7%
Life Sciences	0.4%
	100.0%
	(n = 550)

What is the highest level of education you have completed?

	Weighted Total
Bachelors degree (or less)	45.3%
Masters degree	32.6%
Doctorate	22.1%
	100.0%
	(n = 550)

What is your gender?

	Weighted Total
Male	91.3%
Female	8.7%
	100.0%
	(n = 550)

How many total years of professional work experience (in aerospace) have you had?

	Total Years Work Experience Weighted Total	Total Years Aerospace Work Experience Weighted Total
Zero	0.0%	6.2%
1 to 5 years	16.3%	21.0%
6 to 10 years	17.6%	18.7%
11 to 15 years	13.2%	9.5%
16 to 20 years	6.4%	5.3%
21 to 25 years	9.5%	7.6%
26 to 30 years	21.6%	21.8%
Over 30 years	15.4%	10.1%
	100.0%	100.0%
	(n = 550)	(n = 550)

In your job, how important is it for you to publish scientific and technical information?

	Weighted Total
Very important	47.4%
Somewhat important	28.2%
Not important	24.3%
	100.0%
	(n = 550)

When you need to obtain scientific or technical information, are you more likely to look first to people and resources *within* your center *or* to people and resources *outside* of your center?

	Weighted Total
Within center	88.2%
Outside center	11.8%
	100.0%
	(n = 550)

In your job, how important is it for you to use scientific and technical information?

	Weighted Total
Very important	80.6%
Somewhat important	17.5%
Not important	1.8%
	100.0%
	(n = 550)

In your job, how important is it for you to publish your work through the NASA STI system?

	Weighted Total
Very important	21.6%
Somewhat important	33.6%
Not important	44.8%
	100.0%
	(n = 550)

Have you encountered any problems using the NASA STI system services when you publish?

	Weighted Total
Yes	9.9%
No	61.9%
I don't know / never used	28.1%
	100.0%
	(n = 550)

What problems have you experienced when using the NASA STI system services when you publish?

	Weighted Total
Encountered no problems	90.0%
Process too time consuming	8.6%
Other	1.4%
	100.0%
	(n = 550)

How would you evaluate the overall NASA STI system in terms of supporting you when you publish your work?

	Weighted Total
Excellent	24.6%
Good	37.6%
Fair	8.2%
Poor	2.0%
I don't know / never used	27.6%
	100.0%
	(n = 550)

To perform your job, how important is it for you to use the NASA STI system?

	Weighted Total
Very important	36.6%
Somewhat important	42.5%
Not important	20.9%
	100.0%
	(n = 550)

How many total times per month do you *use* any product or service included in the NASA STI system?

	Weighted Total
Not at all	16.3%
Less than once a month	8.8%
Once a month	25.6%
Twice a month	14.9%
Three to four times a month	15.8%
Five to ten times a month	13.9%
Over ten times a month	4.7%
	100.0%
	(n = 550)

Mean = 3.1 times / month

Median = 1.0 time / month

I noticed that you're not a frequent user of the NASA STI system products and services. Why is that?

	Weighted Total
Not part of my job responsibilities	33.4%
Had no need to use the NASA STI system	23.9%
Information I need is in my office	13.2%
Not familiar with the system	6.3%
Do my own typing, graphics, etc.	5.0%
Use my own computer for searches	4.4%
Prefer outside sources	3.2%
Other	8.6%
	100.0%

(n = 279, rather than 550)

Have you encountered problems using the NASA STI system when you need to access information?

	Weighted Total
Yes	24.6%
No	68.5%
I don't know / don't use	6.9%
	100.0%
	(n = 550)

What problems have you experienced when using the NASA STI system to access information?

	Weighted Total
Encountered no problems	75.0%
Too much time and effort to locate	8.0%
Too much time and effort to obtain	6.4%
System not accurate / precise / reliable	4.1%
Information not available through system	2.4%
Database not extensive enough	2.1%
Information too hard to read / use	2.0%
Abstracts / key word bad	1.7%
Other	0.4%
	100.0%
	(n = 550)

Overall, how important is this NASA STI system (I just described) to you?

	Weighted Total
Very important	47.5%
Somewhat important	35.8%
Not important	16.8%
	100.0%
	(n = 550)

How would you evaluate the overall NASA STI system in terms of meeting your information needs?

	Weighted Total
Excellent	28.2%
Good	54.4%
Fair	9.1%
Poor	1.6%
I don't know / don't use	6.7%
	100.0%
	(n = 550)

Conclusions

- The NASA STI system is used and is important
- The NASA STI system meets the users' information needs
- Problems - production
  - 90% encountered no problems
  - Process is too time consuming (9.0%)
- Problems - access
  - 75% encountered no problems
  - Too much time/effort to locate/obtain information (14.4%)
- Interesting difference between the 5 NASA centers and certain demographics

NONSUPERVISORY PERFORMANCE APPRAISAL (NSPA) 10/1/90 TO 9/30/91

Jane Riddle's comments by Job Element

Page 2 with participation in the Center's Scientific, Technological, and managerial objecives - continued

- This year's combined Reference Transactions, Literature Searches, and Collaborations highlight interests in the following areas:

Earth & Space Sciences

Upper Atmosphere
Meteorology and Climate
Geophysics & Geodesy
Crustal Dynamics
Biospheric Sciences
Hydrology
Astronomy & Astrophysics
Solar Physics
Planetary Systems
Stellar & Galactic Media

Engineering

Sensor Development
Instrumentation
Standards & Calibration
Reliability/Assurance
Payload Engineering
Electromechanics
Robotics
Mission Operations
Cryogenics
Materials

Data Operations & Information Management Series

Data Archiving
Information Systems
Software Engineering
Systems Engineering

Management

TQM
Participative Management
Team Building
End-to-End Project Management
The Individual in the Organization
Cross-generational and Intergender Communication
Demographics and the Workplace

THE KEY USERS AND THE GODDARD LIBRARY SERVICES

WHO ARE THE USERS?

EMPLOYMENT STATUS -

Government

Contractors

NRC/NAS Research Associates

Co-Op Students

Other

GRADE DISTRIBUTION -

GS-10 to 16

AGE CLUSTER -

25 - 55

PROFESSIONAL CATEGORY -

Scientists

Engineers

Managers

RANGE OF DISCIPLINES -

Earth & Space Sciences

Engineering

Data Operations & Information Management

Institutional and Project Management

WHY THEY USE THE LIBRARY -

To locate a specific reference or fact

To explore a topic

To update information on a recurring topic

To browse new materials

To seek help in any of the above

PREFERRED METHOD OF SEEKING INFORMATION -

Computer Data Bases

"Old card catalog" style - microfiche or book KWOC format

Browse "Topical Neighborhoods" in the stacks

Solicit aid in any of the above

WHAT THEY WANT THAT WE PROVIDE -

Long Questions - 15 to 60 minutes

Obscure References

Source rather than bibliographic information

Research Questions

Project Assistance

Conference Support

Information Package

In Print

On Line

Referral Services

Orientation to Library Services and Public OnLine Catalogs

CD-ROM Data Bases

WHAT THEY LIKE MOST -

ARIN

250+ registrants for remote access

Book & Journal Collection

CD-ROM Data Bases

CASI Microfiche

AIAA Papers

WHAT THEY USE LEAST -

Literature Search Update

SCAN

WHAT USERS WANT THAT WE DON'T PROVIDE -

Journal article location through ARIN

ISI

Easy RECON on CD-ROM

A more comprehensive RECON

Electronic Transmission of Search Results

Optical scanning capability

The STI Council User Studies Preliminary Findings

K. Ostergaard

25 October 1991

The STI Council User Studies

Outline

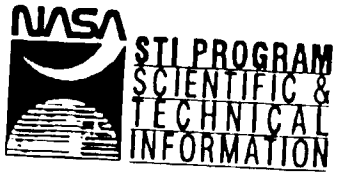
- Background
- Preliminary Findings
- Preliminary Conclusions

Background

The STI Council User Studies

Objectives

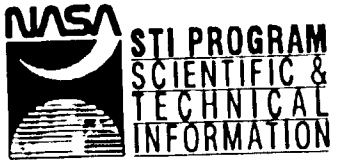
- At a gross level, develop a statistical profile of STI Program use (STI Products and Services Usage Evaluation)
- On an individual basis, collect up-to-date information on current and potential users and their STI needs (STI User Requirements Update)



The STI Council User Studies

Approach

- Develop a usage baseline starting with 1990 CASI statistics
- Supplement this baseline with user and usage information provided by the Center STI Staff and, if possible, the Center Personnel Offices
- Survey a sample of the baseline representing the proportional use of the STI Program across all Centers and emphasizing "high-volume" users
- Also, survey potential/non-users at each Center



Preliminary Findings

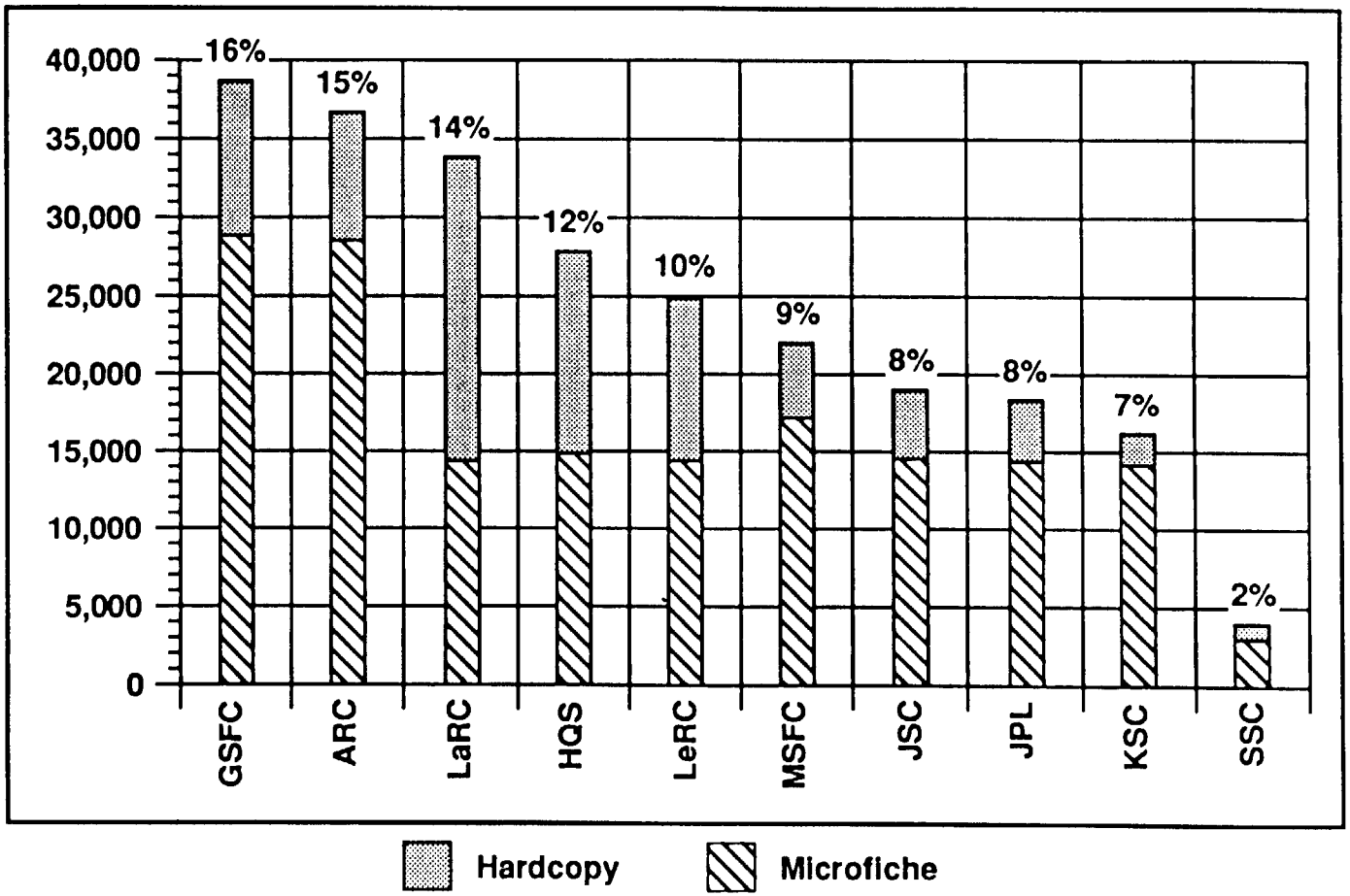
The STI Council User Studies

Preliminary findings are based on:

- A 15 September '91 CASI statistical report for 1990 that is currently undergoing expansion and enhancement
- A recent poll of STI Managers and their staff at each of the Centers

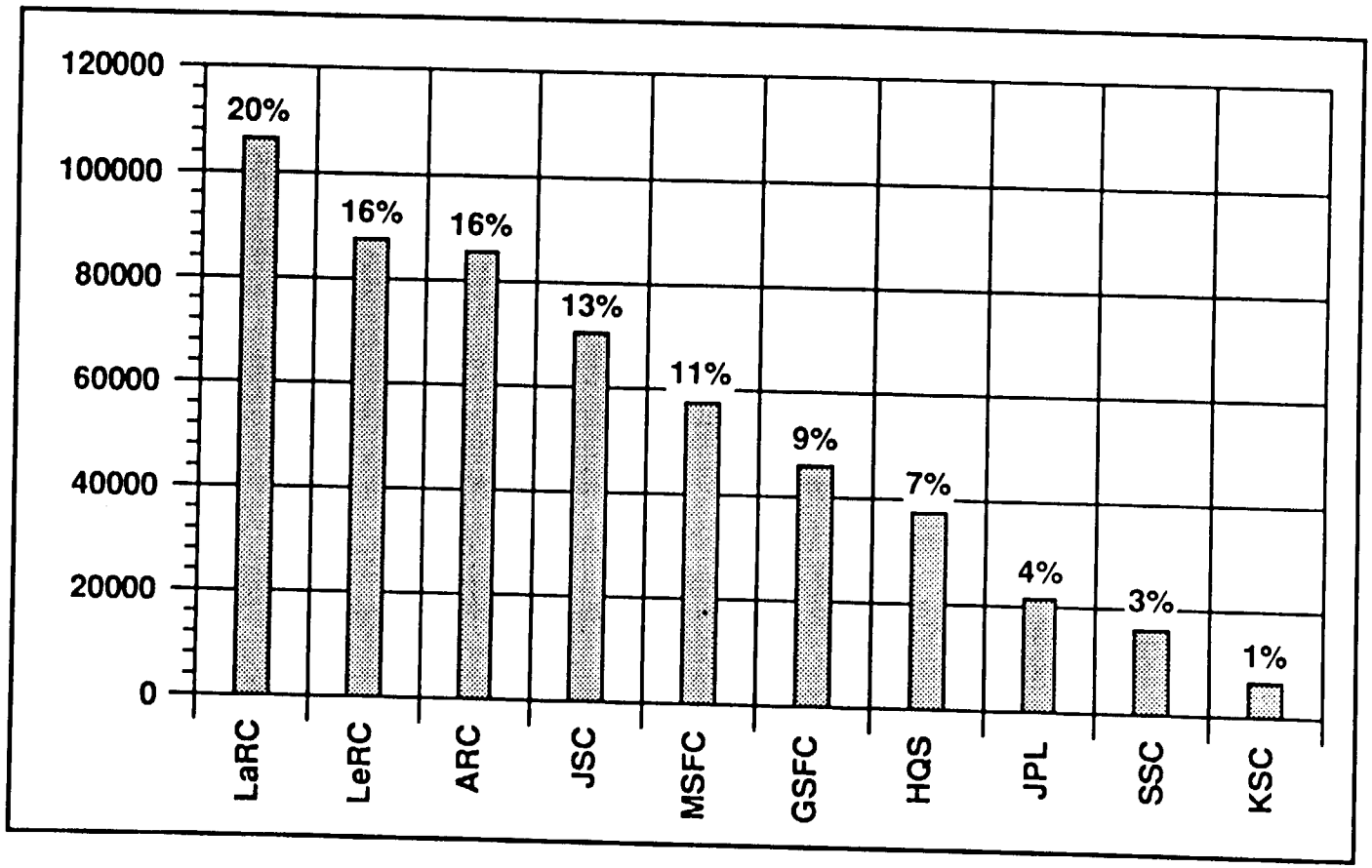
NASA STI PROGRAM SCIENTIFIC & TECHNICAL INFORMATION

1990 Summary Statistics Hardcopy and Microfiche Distributed



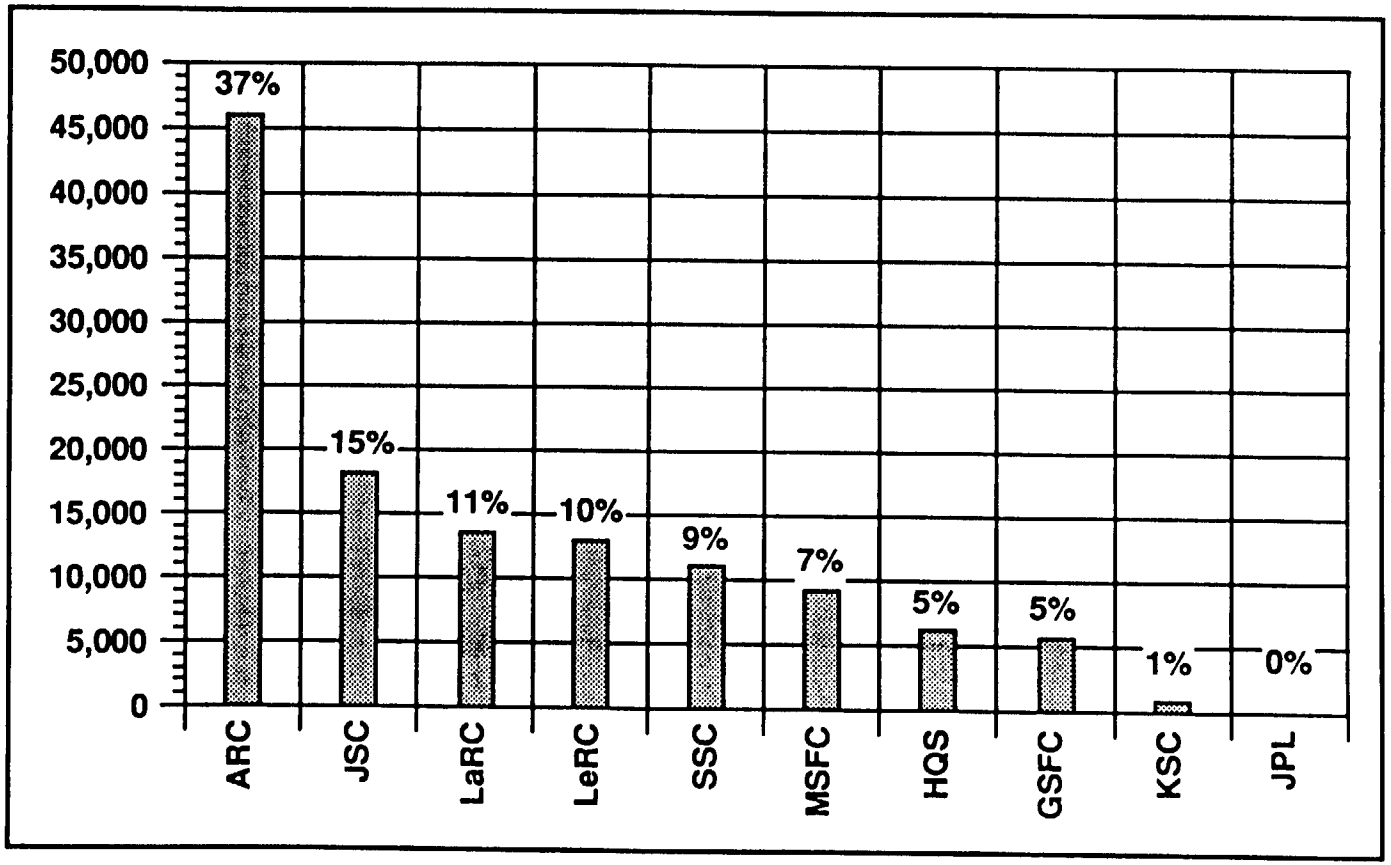
NASA STI PROGRAM SCIENTIFIC & TECHNICAL INFORMATION

1990 Summary Statistics
RECON Commands Executed



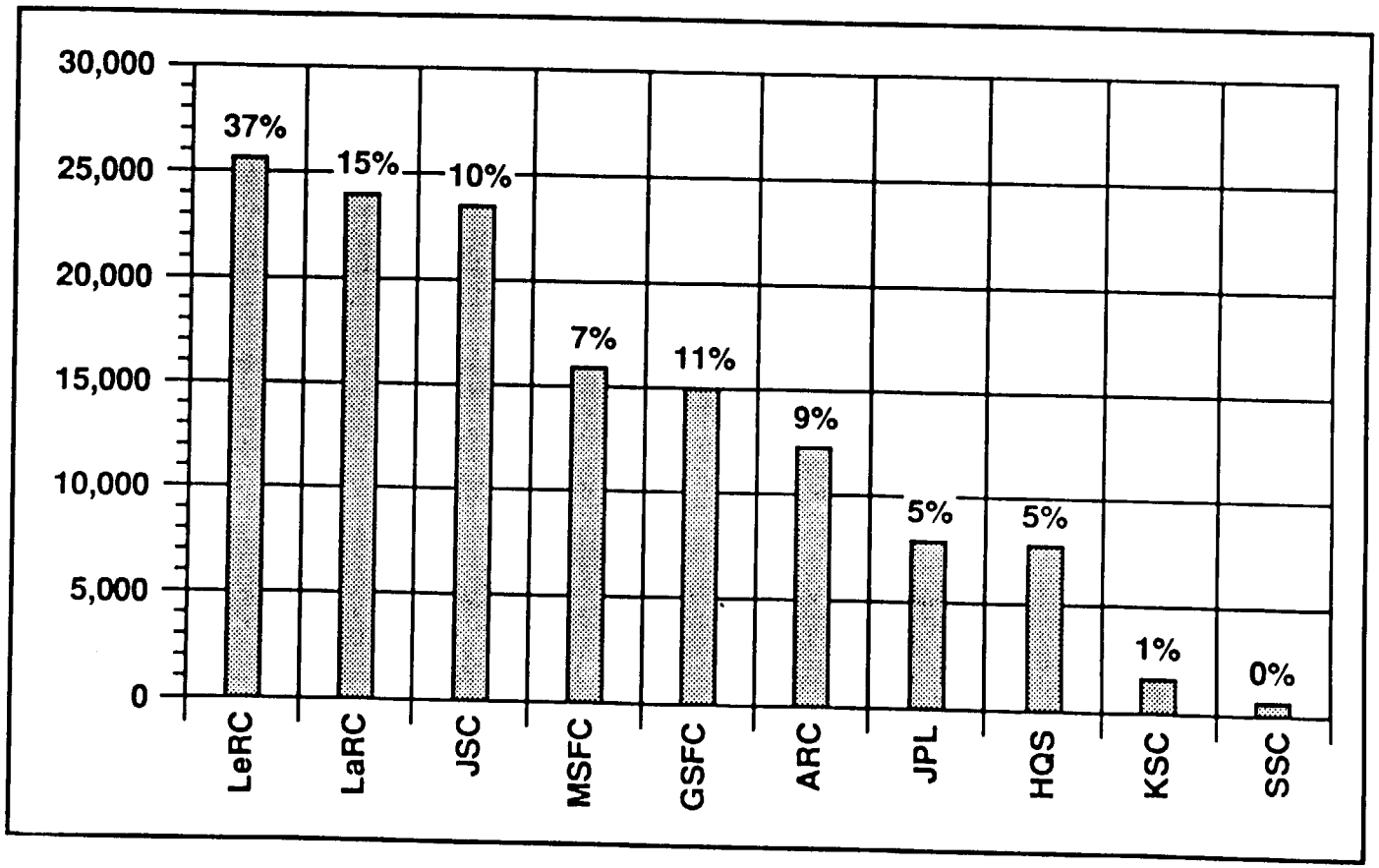
NASA STI PROGRAM SCIENTIFIC & TECHNICAL INFORMATION

1990 Summary Statistics Breakdown of RECON "Browse" Commands



NASA STI PROGRAM SCIENTIFIC & TECHNICAL INFORMATION

1990 Summary Statistics Breakdown of RECON "Expand" Commands



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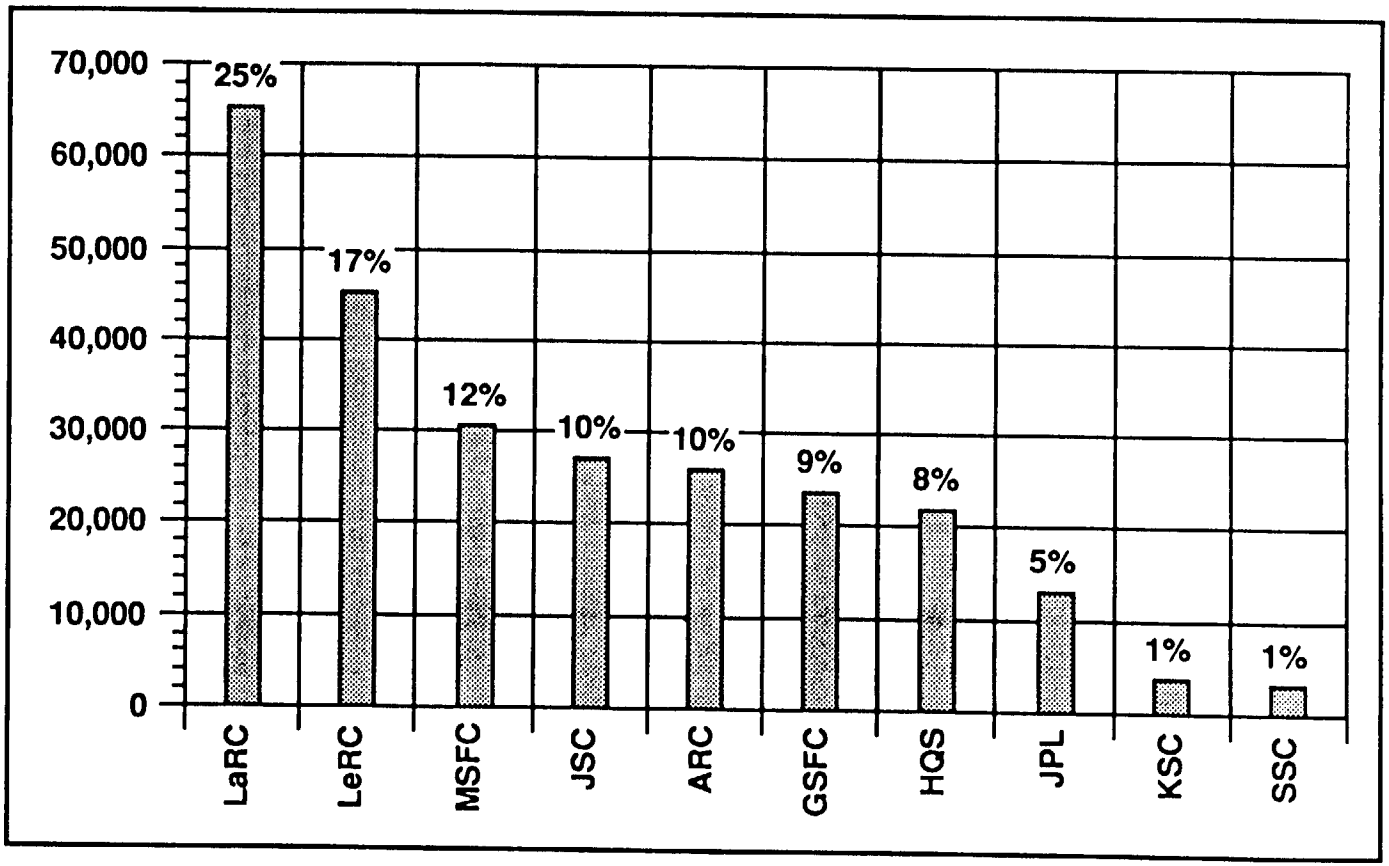
1990 Summary Statistics Breakdown of RECON "Select" Commands



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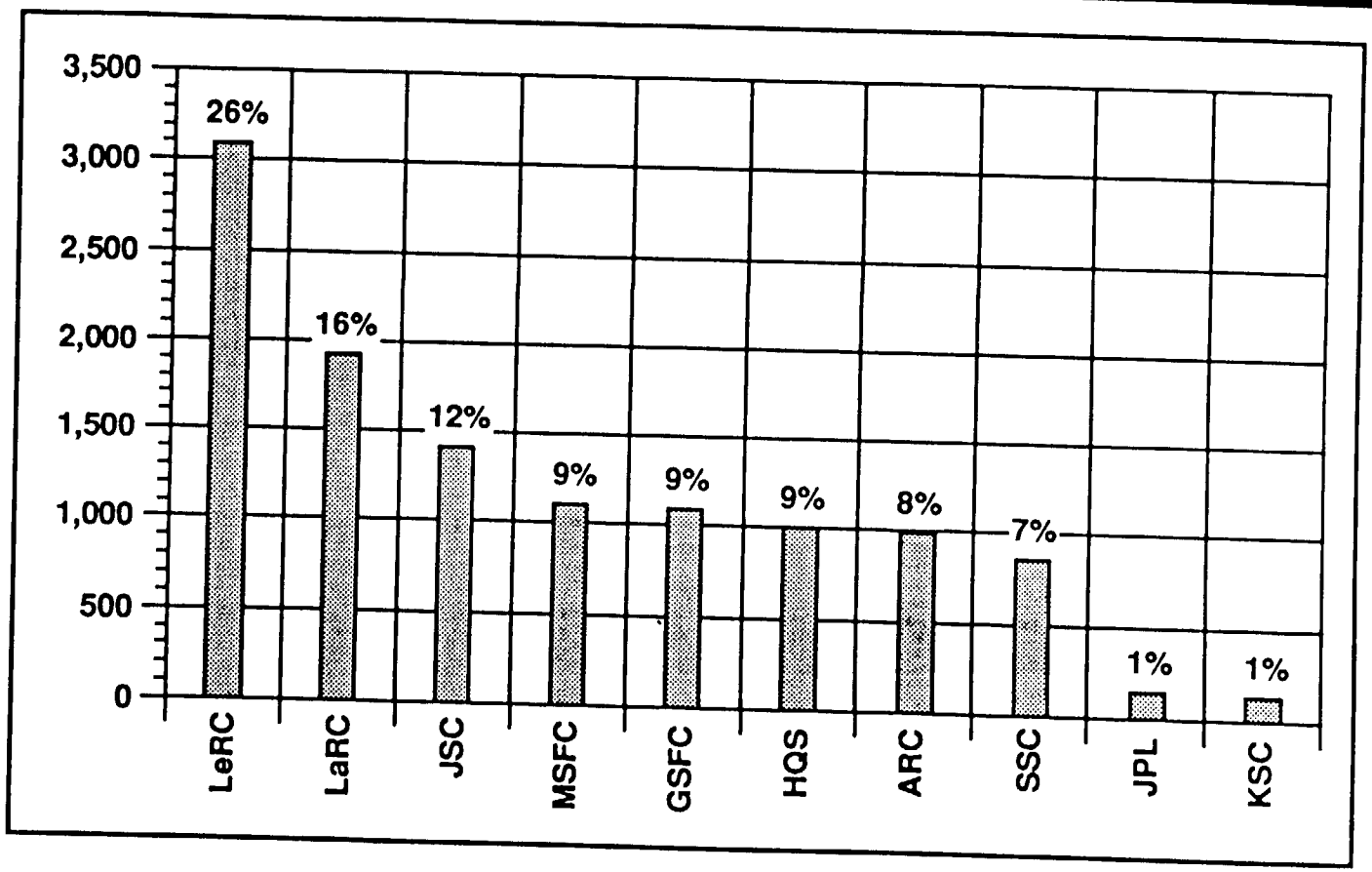
1990 Summary Statistics Breakdown of RECON "Order" Commands



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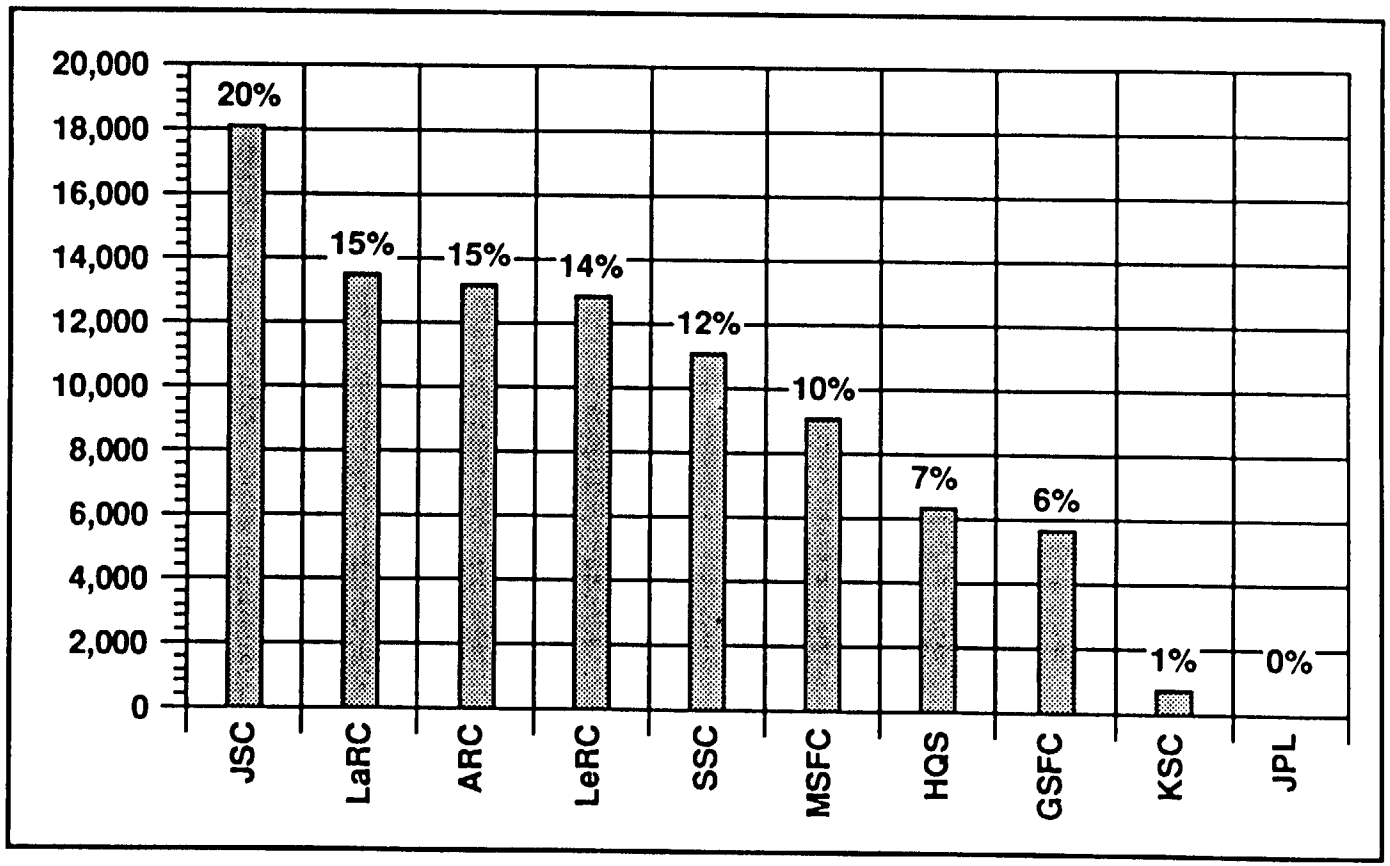
1990 Summary Statistics Breakdown of RECON "Browse" Commands*



* Normalized ARC "Browse" Statistics

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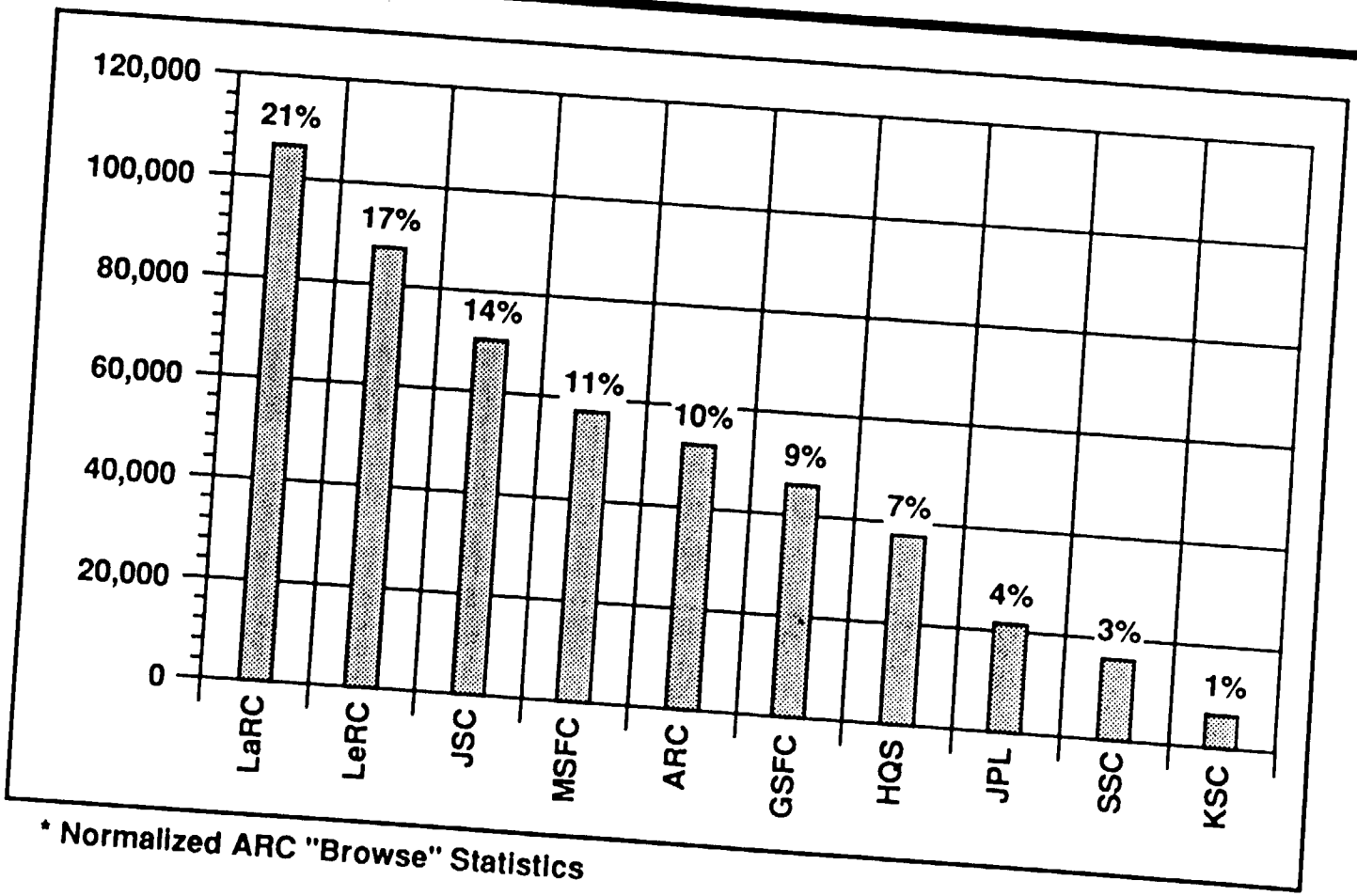
1990 Summary Statistics RECON Commands Executed*



* Normalized ARC "Browse" Statistics

C-2

The 1990 Usage Baseline

Caveats on Interpretation

- Totals include initial distribution
- Offsite NASA contractor use is not reflected
- Use of CASI support is uneven across the Centers, e.g., some Centers do their own photocopy and microfiche blowback while others solicit CASI support
- RECON IDs are routinely reassigned and statistics prior to the reassignment are not included in totals

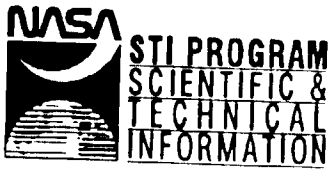
NASA STI PROGRAM SCIENTIFIC & TECHNICAL INFORMATION

The Center STI Staff Poll

Summary of Results

Question	Yes	No/ Not Sure
Estimate total users?	50%	50%
Identify most active users?	75%	25%
Identify less active users?	50%	50%
Maintain usage records?	63%	37%

A total of 8 Centers are represented



Preliminary Conclusions

The STI Council User Studies

Preliminary Conclusions

- Representative sampling based on usage patterns is not feasible given our current state of knowledge
- Statistical information on the provision of Center specific products and services is needed to augment the current baseline
- Descriptive information on Center specific STI policies, search and service modes is needed to refine our interpretation of the baseline
- The Program needs to establish a methodology for monitoring our total user population over time